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# A Generalized Vortex Lattice Method for Subsonic and Supersonic Flow Applications

Luis R. Miranda, Robert D. Elliott,
and William M. Baker

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# A Generalized Vortex Lattice Method for Subsonic and Supersonic Flow Applications

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# A GENERALIZED VORTEX LATTICE METHOD FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS

Luis R. Miranda, Robert D. Elliott, and William M. Baker
Lockheed-California Company

## SUMMARY

A vortex lattice method applicable to both subsonic and supersonic flow is described. It is shown that if the discrete vortex lattice is considered as an approximation to the surface-distributed vorticity, then the concept of the generalized principal part of an integral yields a residual term to the vorticity-induced velocity field. The proper incorporation of this term to the velocity field generated by the discrete vortex lines renders the present vortex lattice method valid for supersonic flow. Special techniques for simulating nonzero thickness lifting surfaces and fusiform bodies with vortex lattice elements are included. Thickness effects of wing-like components are simulated by a double (biplanar) vortex lattice layer, and fusiform bodies are represented by a vortex grid arranged on a series of concentrical cylindrical surfaces. The analysis of sideslip effects by the subject method is described. Numerical considerations peculiar to the application of these techniques are also discussed. A summary comparison of the results obtained by the method of this report with other theoretical and experimental results is presented. This method has been implemented in a digital computer code identified as VORLAX. A users manual for the VORLAX program is contained in Appendix A. A complete Fortran compilation and executed case are contained in Appendix B. Appendices C and D describe input conversion programs useful for transforming input between the VORLAX and NASA Wave Drag programs.

## INTRODUCTION

The several versions or variations of the vortex lattice method that are presently available have proven to be very practical and versatile theoretical tools for the aerodynamic analysis and design of planar and nonplanar configurations. The success of the method is due in great part to the relative simplicity of the numerical techniques involved, and to the high accuracy, within the limitations of the basic theory, of the results obtained. But most of the work on vortex lattice methods appears to have concentrated on subsonic flow application. The applicability of the basic techniques of vortex lattice theory to supersonic flow has been largely ignored. The method presented herein allows the direct extension of vortex lattice techniques to supersonic Mach numbers. The equations allowing this extended application are derived in the next section starting from the first order vector equations governing inviscid compressible flow. They are then applied to the particular case of a skewed-horseshoe vortex with special attention given to the supersonic horseshoe.

In the following theoretical discussion, the basic arguments involved in the simulation of thickness and volume effects by vortex lattice elements are presented. This particular modeling of the above effects represents an alternative, with somewhat reduced computational requirements, to the method of quadrilateral vortex rings (refs. 1 and 2). The simulation of thickness and volume effects makes possible the computation of the surface pressure distribution on wing-body configurations. The fact that this can be done without having to resort to additional types of singularities, such as sources, results in a simpler digital computer code.

## THEORETICAL DISCUSSION

### The Basic Equations

Ward has shown, (ref. 3), that the small-perturbation, linearized flow of an inviscid compressible fluid is governed by the three first order vector equations:

$$\nabla \times \overline{v} = \overline{\omega}, \qquad \nabla . \overline{w} = Q, \qquad \overline{w} = \Psi . \overline{v} \tag{1}$$

on the assumption that the vorticity $\overline{\omega}$ and the source intensity Q are known functions of the point whose position vector is $\overline{R}$. The vector $\overline{v}$ is the perturbation velocity with orthogonal Cartesian components u, v, and w, and $\Psi$ is a constant symmetrical tensor that for orthogonal Cartesian coordinates with the x-axis aligned with the freestream direction has the form

$$\Psi = \begin{bmatrix} 1 - M_\infty^2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \tag{2}$$

where $M_\infty$ is the freestream Mach number. If $\beta^2 = 1-M_\infty^2$, then the vector $\overline{w}$ has the components $\overline{w} = \beta^2 u \,\overline{i} + v \,\overline{j} + w \,\overline{k}$. This vector was first introduced by Robinson (ref. 4), who called it the "reduced current velocity". If $\overline{u}$ denotes the total velocity vector, i.e., $\overline{u} = (u_\infty + u)\,\overline{i} + v\,\overline{j} + w\,\overline{k}$, and $\rho$ the fluid density, then it can be shown that for irrotational and homentropic flow

$$\rho\,\overline{u} = \rho_\infty \overline{u}_\infty + \rho_\infty \overline{w} + \text{higher order terms} \tag{3}$$

where the subscript $\infty$ indicates the value of the quantity at upstream infinity, e.g., $\overline{u}_\infty = u_\infty \overline{i}$. Therefore, to a linear approximation, the vector $\overline{w}$ is directly related to the perturbation mass flux as follows:

$$\overline{w} = (\rho\,\overline{u} - \rho_\infty \overline{u}_\infty)\,/\rho_\infty \tag{4}$$

The second equation of (1), i.e., the continuity condition, shows that for source-free flows (Q = 0), w is a conserved quantity.

Ward has integrated the three first order vector equations directly without having to resort to an auxiliary potential function. He obtained two different solutions for $\overline{v}\,(\overline{R})$, depending on whether $\beta^2$ is positive (subsonic flow), or negative (supersonic flow). These two solutions can be combined formally into a single expression if the following convention is used:

$K = 2$ for $\beta^2 > 0$

$K = 1$ for $\beta^2 < 0$

$R_\beta = \text{Real part of} \left\{(x-x_1)^2 + \beta^2\left[(y-y_1)^2 + (z-z_1)^2\right]\right\}^{1/2}$

$\fint$ = Finite part of integral as defined by Hadamard (refs. 5 and 6).

The resulting solution for the perturbation velocity $\bar{v}$ at the point whose position vector is $\bar{R}_1 = x_1 \bar{i} + y_1 \bar{j} + z_1 \bar{k}$, is given by

$$\bar{v}(\bar{R}_1) = -\frac{1}{2\pi K} \fint_S \bar{n} \cdot \bar{w}(\bar{R}) \nabla \frac{1}{R_\beta} \, dS$$

$$+ \frac{\beta^2}{2\pi K} \fint_S \{\bar{n} \times \bar{v}(\bar{R})\} \times \frac{\bar{R} - \bar{R}_1}{R_\beta^3} \, dS$$

$$+ \frac{1}{2\pi K} \fint_V Q(\bar{R}) \nabla \frac{1}{R_\beta} \, dV + \frac{\beta^2}{2\pi K} \fint_V \frac{\bar{R}-\bar{R}_1}{R_\beta^3} \times \bar{\omega}(\bar{R}) \, dV \qquad (5)$$

This formula determines the value of $\bar{v}$ within the region V bounded by the surface S. The vector $\bar{n}$ is the unit outward (from the region V) normal to the surface S. Furthermore, it is understood that for supersonic flow only those parts of V and S lying within the domain of dependence (Mach forecone) of the point $\bar{R}_1$ are to be included in the integration.

For source-free ($Q \equiv 0$), irrotational ($\bar{\omega} \equiv 0$) flow, equation (5) reduces to

$$\bar{v}(\bar{R}_1) = -\frac{1}{2\pi K} \fint_S \bar{n} \cdot \bar{w}(\bar{R}) \nabla \frac{1}{R_\beta} \, dS + \frac{\beta^2}{2\pi K} \fint_S \{\bar{n} \times \bar{w}(\bar{R})\} \frac{\bar{R}-\bar{R}_1}{R_\beta^3} \, dS \qquad (6)$$

This is a relation between $\bar{v}$ inside S and the values of $\bar{n} \cdot \bar{w}$ and $\bar{n} \times \bar{v}$ on S, but these two quantities cannot be specified independently on S.

To determine the source-free, irrotational flow about an arbitrary body B by means of equation (6), assume that the surface S coincides with the wetted surface of the body, with any trailing wake that it may have, and with a sphere of infinite radius enclosing the body and the whole flow field about it, namely, $S = S_B + S_W + S_\infty$.

This surface S divides the space into two regions, $V_e$ external to the body, and $V_i$ internal to it. Applying equation (6) to both $V_e$ and $V_i$, since the integrals over $S_\infty$ converge to zero, the following expression is obtained:

$$\bar{v}(\bar{R}_1) = \frac{1}{2\pi K} \fint_{S_B + S_W} \bar{N} \cdot \Delta \bar{w}(\bar{R}) \nabla \frac{1}{R_\beta} \, dS - \frac{\beta^2}{2\pi K} \fint_{S_B + S_W} \{\bar{N} \times \Delta \bar{v}(\bar{R})\} \times \frac{\bar{R}-\bar{R}_1}{R^3_\beta} \, dS \qquad (7)$$

where $\bar{N} = \bar{n}_i = -\bar{n}_e$ is the unit normal to the body, or wake as the case may be, positive from the interior to the exterior of the body, $\Delta \bar{w} = \bar{w}_e - \bar{w}_i$, and $\Delta \bar{v} = \bar{v}_e - \bar{v}_i$. Here the subscripts designate the values of the quantities on the corresponding face of S. The first surface integral can be considered as representing the contribution of a source distribution of surface density $\bar{N} \cdot \Delta \bar{w}$, while the second surface integral gives the contribution of a vorticity distribution of surface density $\bar{N} \times \Delta \bar{v}$.

If the boundary condition of zero mass flux through the surface $S_B + S_W$ is applied to both external and internal flows

$$\begin{aligned} \bar{N} \cdot \rho \bar{u}_e &= \bar{N} \cdot (\rho_\infty \bar{u}_\infty + \rho_\infty \bar{w}_e) = 0 \\ \bar{N} \cdot \rho \bar{u}_i &= \bar{N} \cdot (\rho_\infty \bar{u}_\infty + \rho_\infty \bar{w}_i) = 0 \end{aligned} \qquad (8)$$

then the condition $\bar{N} \cdot \Delta \bar{w} = 0$ exists over $S_B + S_W$, and the flow field is uniquely determined by

$$\bar{v}(\bar{R}_1) = -\frac{\beta^2}{2\pi K} \fint_{S_B + S_W} \bar{\gamma}(\bar{R}) \times \frac{\bar{R}-\bar{R}_1}{R^3_\beta} \, dS \qquad (9)$$

where $\bar{\gamma}(\bar{R}) = \bar{N} \times \Delta \bar{v}$ is the surface vorticity density.

## Extension to Supersonic Flow

In order to extend the application of the vortex lattice method to supersonic flow, it is essential to consider the fundamental element of the method, the vortex filament, as a numerical approximation scheme to the integral expression (9) instead of a real physical entity. The velocity field generated by a vortex filament can be obtained by a straightforward limiting process, the result being

$$\bar{v}(\bar{R}_1) = \frac{-\beta^2}{2\pi K} \fint_C \bar{\Gamma} \times \frac{\bar{R}-\bar{R}_1}{R^3_\beta} \, d\ell \qquad (10)$$

where $\bar{\Gamma} = \lim\limits_{\substack{\bar{\gamma} \to \infty \\ \delta \to 0}} \bar{\gamma} \cdot \delta$

$\delta$ is a dimension normal to $\gamma$, and $d\ell$ is the distance element along $\gamma$. In the classical vortex lattice method, applicable only to subsonic flow, the vorticity distribution over the body and the wake, i.e., over the surface $S_B + S_W$, is replaced by a suitable arrangement of vortex filaments whose velocity fields are everywhere determined by equation (10). This procedure is no longer appropriate for supersonic flow. For this latter case, it is necessary to go back to equation (9) and to derive an approximation to it. This is done in the following.

If the surface $S_B + S_W$, which defines the body and its wake, is considered as being composed of a large number of discrete flat area elements $\tau$ over which the surface vorticity density $\bar{\gamma}$ can be assumed approximately constant, then equation (9) can be approximated by the following equation:

$$\bar{v}(\bar{R}_1) = -\frac{\beta^2}{2\pi K} \sum_{J=1}^{N} \int_{\tau_J} \bar{\gamma}_J \times \frac{\bar{R}-\bar{R}_1}{R^3_{\beta}} \, dS \tag{11}$$

where N is the total number of discrete area elements $\tau$. When the point whose position vector is $\bar{R}_1$ is not part of $\tau_J$, the integral over this discrete area can be approximated by the mean value theorem as follows:

$$\int_{\tau_J} \bar{\gamma}_J \times \frac{\bar{R}-\bar{R}_1}{R^3_{\beta}} \, dS = \bar{\gamma}_J \; \delta_J \times \int_{C_J} \frac{\bar{R}-\bar{R}_1}{R^3_{\beta}} \, d\ell \tag{12}$$

where $C_J$ is a line in $\tau_J$ parallel to the average direction of $\bar{\gamma}$ in $\tau_J$, $\delta_J$ is a distance normal to $C_J$, and $d\ell$ is the arc length element along $C_J$. This means that the velocity field induced by a discrete vorticity patch $\tau_J$ can be approximated for points outside of $\tau_J$ by some mean discrete vortex line whose strength per unit length is $\gamma_J \, \delta_J$. But if the point $\bar{R}_1$ is part of the discrete area $\tau$, the integral in equation (11) has an inherent singularity of the Cauchy type due to the fact that $\bar{R} = \bar{R}_1$ at some point within $\tau$. In order to evaluate the integral expression for this case, consider a point close to $\bar{R}_1$ but located just above $\tau$ by a distance $\epsilon$. As indicated in figure 1, the area of integration in $\tau$ is divided into two regions, $A_{\tau-\epsilon}$ and $A_{\epsilon}$. Obviously, the integral over $A_{\tau-\epsilon}$ has no Cauchy-type singularity, Hadamard's finite part concept being sufficient to perform the indicated integration. Thus,

$$\fint_{\tau} \bar{\gamma} \times \frac{\bar{R}-\bar{R}_1}{R^3_{\beta}}\, dS = \lim_{\epsilon \to 0} \fint_{A_\epsilon} + \lim_{\epsilon \to 0} \fint_{A_{\tau-\epsilon}}$$

$$= \lim_{\epsilon \to 0} I(\epsilon) + \bar{\gamma}\, \beta \times \fint_{C} \frac{\bar{R}-\bar{R}_1}{R^3_{\beta}}\, dl \qquad (13)$$

The last integral in equation (13) represents the conventional discrete vortex line contribution whose evaluation presents no difficulty. In order to determine the integration denoted by $I(\epsilon)$ assume that, for simplicity, the coordinate system is centered at the point $\bar{R}_1$, and that the x-y plane is determined by the discrete area $\tau$. Then, if $\gamma$ denotes the modulus of $\bar{\gamma}$,

$$I(\epsilon) = \gamma \fint_{A_\epsilon} \frac{y \sin\Lambda - x \cos\Lambda}{\{x^2 - B^2 (y^2 + \epsilon^2)\}^{3/2}}\, dx\, dy \qquad (14)$$

where $\Lambda$ is the angle between the y-axis and the direction of the vorticity in $\tau$, and $B^2 = -\beta^2 > 0$ (supersonic flow). The components of the vector cross product $\bar{\gamma} \times (\bar{R}-\bar{R}_1) = \bar{\gamma} \times \bar{R}$ which are not normal to the plane of $\tau$ have been left out of equation (14) because, when the limit operation $\epsilon \to 0$ is carried out, they will vanish. The area $A_\epsilon$ is bounded by a line parallel to the vorticity direction going through $x -(1+B)\epsilon$ and by the intersection of the Mach forecone from the point $(0, 0, \epsilon)$ with the $\tau$-plane, consequently, if the integration with respect to x is performed first,

$$I(\epsilon) = \gamma \cos\Lambda \fint_{\lambda_1}^{\lambda_2} \left\{ \fint_{ty-(1+B)\epsilon}^{-B\sqrt{y^2+\epsilon^2}} \frac{ty - x}{\{x^2 - B^2 (y^2 + \epsilon^2)\}^{3/2}}\, dx \right\} dy \qquad (15)$$

where $t = \tan\Lambda$, and $\lambda_1$, $\lambda_2$ are the values of y corresponding to the intersection of the line $x = ty -(1+B)\epsilon$ with the hyperbola $x = -B\sqrt{y^2 + \epsilon^2}$. Let $\phi = \epsilon^2(1+2B) - 2(1+B)\epsilon t y - (B^2 - t^2)\, y^2$, then the finite part of the x-integration yields

$$I(\epsilon) = \gamma \cos\Lambda \fint_{\lambda_1}^{\lambda_2} \left\{ \frac{ty\,(ty-(1+B)\epsilon)}{B^2 (y^2 + \epsilon^2)\sqrt{\phi}} - \frac{1}{\sqrt{\phi}} \right\} dy$$

$$= \frac{\gamma \cos \Lambda}{B^2} \fint_{\lambda_1}^{\lambda_2} \left\{ \frac{B^2 \epsilon - (1+B)\ \epsilon t y - (B^2 - t^2) y^2}{y^2 + \epsilon^2} \right\} \frac{dy}{\sqrt{\phi}} \tag{16}$$

Since $\epsilon$ is a very small quantity, the variation of y in the interval $(\lambda_1, \lambda_2)$ is going to be equally small, and, therefore, the quantity within brackets in the last integrand of equation (16) can be replaced by a mean value and taken outside of the integral sign. The same is not true of the term $1/\sqrt{\phi}$ since it will vary from $\infty$ for $y = \lambda_1$, go through finite values in the integration interval, and then again increase to $\infty$ for $y = \lambda_2$. With this in mind, and if $\tilde{y}$ denotes a mean value of y, $I(\epsilon)$ can be written as

$$I(\epsilon) = \frac{\gamma \cos \Lambda}{B^2} \; \frac{B^2 \epsilon - (1+B)\ \epsilon t \tilde{y} - (B^2 - t^2)\ \tilde{y}^2}{\tilde{y}^2 + \epsilon^2} \fint_{\lambda_1}^{\lambda_2} \frac{dy}{\sqrt{\phi}} \tag{17}$$

But $\lambda_1$, $\lambda_2$ are the roots of $ty - \epsilon = -B\sqrt{y^2 + \epsilon^2}$, i.e., they are the roots of the polynomial denoted by $\phi$. Thus

$$\sqrt{\phi} = \sqrt{\epsilon^2(1+2B) - 2(1+B)\epsilon t y \ - (B^2 - t^2)\ y^2} = \sqrt{B^2 - t^2} \cdot \sqrt{(\lambda_1 - y)(y - \lambda_2)} \tag{18}$$

Introducing this expression for $\sqrt{\phi}$ into (17), and taking the limit $\epsilon \to o$, the following value for $I(\epsilon)$ is obtained:

$$I(o) = \lim_{\epsilon \to o} I(\epsilon) = -\frac{\gamma \cos \Lambda}{B^2} \sqrt{B^2 - t^2} \fint_{\lambda_1}^{\lambda_2} \frac{dy}{\sqrt{(\lambda_1 - y)(y - \lambda_2)}} \tag{19}$$

The integral appearing in equation (19) can be easily evaluated by complex variable methods; its value is found to be

$$\fint_{\lambda_1}^{\lambda_2} \frac{dy}{\sqrt{(\lambda_1 - y)(y - \lambda_2)}} = \pi \tag{20}$$

The contribution of the inherent singularity to the velocity field, within $\tau$, induced by the vorticity patch $\tau$, and dented herein by w*, is therefore given by

$$w^{*} = -\frac{\beta^2}{2\pi} \lim_{\varepsilon \quad o} I(\varepsilon) = -\frac{\gamma \cos \Lambda}{2} \sqrt{B^2 - t^2} \tag{21}$$

This contribution is perpendicular to the plane of $\tau$, and it has only physical meaning when $B^2 > t^2$, i.e., when the vortex lines are swept in front of the Mach lines. It is expression (21), taken in conjunction with equations (11) and (12), that makes the vortex lattice method applicable to supersonic flow.

## The Skewed-Horseshoe Vortex

Velocity fields due to complex vortex curves can be generated by the linear superposition of fields induced by simple vortex geometries. For instance, the velocity field due to a horseshoe line vortex can be obtained by the addition of the corresponding fields induced by three rectilinear segments: a transverse skewed segment, and two trailing legs, figure 2. Therefore, the determination of the velocity field due to a line vortex segment of constant, but arbitrary, sweep is the fundamental building block in the formulation of aerodynamic influence coefficients of complex three-dimensional vortex lattices. Choosing a coordinate system such that the vortex line lies in the plane $z = 0$, the conventional discrete vortex contribution to the velocity at a point whose coordinates are $(x_o, y_o, z_o)$ is given, in Cartesian components, by the following expressions

$$\begin{aligned}
u &= +\frac{\Gamma^{z}_{o}}{2\pi K}\, \beta^2 \oint_C \frac{dy}{\left\{ (x-x_o)^2 + \beta^2 \left( (y-y_o)^2 + z_o^{\,2} \right) \right\}^{3/2}} \\
v &= -\frac{\Gamma^{z}_{o}}{2\pi K}\, \beta^2 \oint_C \frac{dx}{\left\{ (x-x_o)^2 + \beta^2 \left( (y-y_o)^2 + z_o^{\,2} \right) \right\}^{3/2}} \\
w &= +\frac{\Gamma}{2\pi K}\, \beta^2 \oint_C \frac{(x-x_o)\, dy - (y-y_o)}{\left\{ (x-x_o)^2 + \beta^2 \left( (y-y_o)^2 + z_o^{\,2} \right) \right\}^{3/2}}
\end{aligned} \tag{22}$$

where $\Gamma$ represents the circulation per unit length of discrete vortex line length, and the integrations are to be carried out along that part of C which satisfies the conditions

$$(x - x_o)^2 + \beta^2 \left((y - y_o)^2 + z_o^2\right) > 0$$

and

$$x - x_o < 0 \quad \text{if} \quad M_\infty > 1.$$

For the transverse leg of the horseshoe vortex, the coordinate x appearing in equations (22) can be expressed as a function of y, i.e., $x = ty$, and the indicated integrations carried out between the limits $y = -s$ and $y = +s$, figure 2. By defining the following auxiliary variables

$$x_1 = x_o + ts \qquad x_2 = x_o - ts$$

$$y_1 = y_o + s \qquad y_2 = y_o - s$$

$$X^* = x_o - ty_o$$

The resulting formulas giving the velocity components induced by the skewed transverse rectilinear vortex filament can be written as follows:

$$\left.\begin{aligned}
u &= +\frac{\Gamma z}{2\pi K}\cdot\frac{1}{x^{*2} + (t^2+\beta^2)\,z_o^2}\cdot\left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2\,(y_1^2+z_o^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2\,(y_2^2+z_o^2)}}\right]\\
v &= -\frac{\Gamma z}{2\pi K}\cdot\frac{t}{x^{*2} + (t^2+\beta^2)\,z_o^2}\cdot\left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2\,(y_1^2+z_o^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2\,(y_2^2+z_o^2)}}\right]\\
w &= -\frac{\Gamma}{2\pi K}\quad\frac{x^*}{x^{*2} + (t^2+\beta^2)\,z_o^2}\quad\left[\frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2\,(y_1^2+z_o^2)}} - \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2\,(y_2^2+z_o^2)}}\right]
\end{aligned}\right\} \tag{23}$$

In the above expressions, the coordinates $(x_o, y_o, z_o)$ of the receiving field point are measured with respect to the midpoint of the rectilinear vortex segment, the x-y plane of the coordinate system coinciding with the plane defined by the x-axis and the vortex itself.

The case of a rectilinear vortex segment parallel to the x-axis $(t = \infty)$ is of special importance since the trailing legs of a horseshoe vortex are generally assumed to be parallel to the x-axis. Since $dy = 0$, equations (22) become

$$u = 0$$

$$v = -\frac{\Gamma z_o}{2\pi K}\,\beta^2 {\int\!\!\!\!\!\!-}_c \frac{dx}{\left\{(x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right)\right\}^{3/2}} \tag{24}$$

$$w = -\frac{\Gamma(y-y_o)}{2\pi K}\,\beta^2 {\int\!\!\!\!\!\!-}_c \frac{dx}{\left\{(x-x_o)^2 + \beta^2\left((y-y_o)^2 + z_o^2\right)\right\}^{3/2}}$$

If the vortex segment extends from $x = x_i$ to $x = x_f$, the above integration yields

$$u = 0$$

$$v = -\frac{\Gamma z_o}{2\pi K}\left[\frac{x_o - x_i}{\sqrt{(x_o-x_i)^2 + \beta^2\left((y_o-y)^2 + z_o^2\right)}} - \frac{x_o - x_f}{\sqrt{(x_o-x_f)^2 + \beta^2\left((y_o-y) + z_o^2\right)}}\right]\frac{1}{(y_o-y)^2 + z_o^2} \tag{25}$$

$$v = +\frac{\Gamma}{2\pi K}\left[\frac{x_o - x_i}{\sqrt{(x_o-x_i)^2 + \beta^2\left((y_o-y)^2 + z_o^2\right)}} - \frac{x_o - x_f}{\sqrt{(x_o-x_f)^2 + \beta^2\left((y_o-y) + z_o^2\right)}}\right]\frac{y_o - y}{(y_o-y)^2 + z_o^2}$$

For a conventional horseshoe vortex whose trailing legs stretch to downstream infinity, equations (25) would give the contribution of the port leg with the following substitutions

$x_i = \infty$ if $M_\infty < 1$

$x_i = x_o - \sqrt{-\beta^2\left((y_o+s)^2 + z_o^2\right)}$ if $M_\infty > 1$

$x_f = -ts$

$y = -s$

Likewise, the contribution from the starboard trailing leg can be computed by introducing the following values into equations (25)

$$x_i = +ts$$

$$x_f = \infty \quad \text{if} \quad M_\infty < 1$$

$$x_f = x_o - \sqrt{-\beta^2 \left((y_o - s)^2 + z_o^2\right)} \quad \text{if} \quad M_\infty > 1$$

$$y = +s$$

Combining these results with equations (23), the formulas defining the flow field induced by a discrete vortex consisting of a skewed segment and two trailing legs parallel to the x-axis (the skewed-horseshoe vortex) are obtained. Keeping in mind Hadamard's finite part concept, and after introducing the following notation

$$F_1 = \frac{tx_1 + \beta^2 y_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_o^2)}} \quad ;$$

$$F_2 = \frac{tx_2 + \beta^2 y_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_o^2)}} \quad ;$$

$$G_1 = \frac{x_1}{\sqrt{x_1^2 + \beta^2 (y_1^2 + z_o^2)}} + C \quad ; \quad (M_\infty < 1:\ C = 1;\ M_\infty > 1:\ C = 0) \tag{26}$$

$$G_2 = \frac{x_2}{\sqrt{x_2^2 + \beta^2 (y_2^2 + z_o^2)}} + C \quad ; \quad (M_\infty < 1:\ C = 1;\ M_\infty > 1:\ C = 0)$$

then, the horseshoe vortex induced field formulas can be expressed as follows:

$$u\,(x_o, y_o, z_o) \;=\; +\;\frac{\Gamma}{2\pi K}\;\frac{z_o}{x^{*2} + (t^2 + \beta^2)\,z_o^{\,2}}\;(F_1 - F_2)$$

$$v\,(x_o, y_o, z_o) \;=\; +\;\frac{\Gamma}{2\pi K}\,z_o\left\{-\,\frac{(F_1 - F_2)\,t}{x^{*2} + (t^2 + \beta^2)\,z_o^{\,2}} + \frac{G_1}{y_1^{\,2} + z_o^{\,2}} - \frac{G_2}{y_2^{\,2} + z_o^{\,2}}\right\} \qquad (27$$

$$w\,(x_o, y_o, z_o) \;=\; -\;\frac{\Gamma}{2\pi K}\left\{\frac{x^{*}\,(F_1 - F_2)}{x^{*2} + (t^2 + \beta^2)\,z_o^{\,2}} + \frac{y_1}{y_1^{\,2} + z_o^{\,2}}\,G_1 - \frac{y_2}{y_2^{\,2} + z_o^{\,2}}\,G_2\right\}$$

The finite part concept determines the value of the constant C appearing in the definition of $G_1$ and $G_2$.

A notable simplification of equations (27) occurs for supersonic flow when the receiving point $(x_o, y_o, z_o)$ is in the plane of the horseshoe, namely, $z_o = 0$. First, the values of the axialwash and sidewash, u and v, vanish identically; secondly, the upwash expression becomes

$$w\,(x_o, y_o, 0) \;=\; -\;\frac{\Gamma}{2\pi K}\left\{\frac{F_1 - F_2}{x^{*}} + \frac{G_1}{y_1} - \frac{G_2}{y_2}\right\} \qquad (28$$

Equation (28) is applicable to both subsonic and supersonic flow in its present format. But for the supersonic flow case, the fact that the constant C of the G functions becomes null due to the finite part concept allows further simplification of the upwash equation. Introducing the corresponding values of the F and G functions, the expanded version of equation (28) is

$$w\,(x_o, y_o, 0) \;=\; -\;\frac{\Gamma}{2\pi K}\left\{\frac{1}{x^{*}}\left[\frac{t x_1 + \beta^2 y_1}{\sqrt{x_1^{\,2} + \beta^2\,y_1^{\,2}}} - \frac{t x_2 + \beta^2 y_2}{\sqrt{x_2^{\,2} + \beta^2\,y_2^{\,2}}}\right] + \frac{x_1/y_1}{\sqrt{x_1^{\,2} + \beta^2\,y_1^{\,2}}} - \frac{x_2/y_2}{\sqrt{x_2^{\,2} + \beta^2\,y_2^{\,2}}}\right\} \qquad (29$$

Since $x^* = x_o - ty_o = x_1 - ty_1 = x_2 - ty_2$, the rearrangement of equation (28) in factors of $\left[(x_1 - ty_1)\sqrt{x_1^2 + \beta^2 y_1^2}\right]^{-1}$ and $\left[(x_2 - ty_2)\sqrt{x_2^2 + \beta^2 y_2^2}\right]^{-1}$ finally reduces the upwash formula to

$$w\,(x_o, y_o\; 0) = -\frac{\Gamma}{2\pi K} \cdot \frac{1}{x^*} \left\{ \frac{\sqrt{x_1^{\,2} + \beta^2\, y_1^{\,2}}}{y_1} - \frac{\sqrt{x_2^{\,2} + \beta^2\, y_2^{\,2}}}{y_2} \right\} \tag{30}$$

When the field point $(x_o, y_o, 0)$ is within the distributed vorticity patch which is approximated by the discrete horseshoe vortex, e.g., the control point associated with the horseshoe, the upwash given by equation (30) has to be complemented by the distribution due to the generalized principal part of the upwash integral, as given by equation (21). If $\delta x$ is the distance, measured in the x-direction, occupied by the distributed vorticity $\gamma$ which has been lumped into the discrete transverse vortex leg of circulation $\Gamma$, the relationship between the $\gamma$ of equation (21) and the $\Gamma$ of equations (27) and (30) is

$$\Gamma = \gamma \cos \Lambda\, \delta x \tag{31}$$

## Modeling of Lifting Surfaces with Thickness

The method of quadrilateral vortex rings placed on the actual body surface (ref. 1) provides a way of computing the surface pressure distribution of arbitrary bodies using discrete vortex lines only. Numerical difficulties may occur when the above method is applied to the analysis of airfoils with sharp trailing edges due to the close proximity of two vortex surfaces of nearly parallel direction. An alternative approach, requiring somewhat less computer storage and easier to handle numerically, consists in using a double, or biplanar, sheet of swept horseshoe vortices to model a lifting surface with thickness, as shown schematically in figure 3. This constitutes an approximation to the true location of the singularities, similar in nature to the classical lifting surface theory approximation of a cambered sheet.

All the swept horseshoe vortices, and their boundary condition control points, corresponding to a given surface, upper or lower, are located in a same plane. The upper and lower surface lattice planes are separated by a gap which represents the chordwise average of the airfoil thickness distribution. The results are not too sensitive to the magnitude of this gap; any value between one half to the full maximum chordwise thickness of the airfoil has been found to be adequate, the preferred value being two thirds of the maximum thickness. Furthermore, the gap can vary in the direction normal to the x-axis to allow for spanwise thickness taper. On the other hand, the chordwise distribution, or spacing, of the transverse elements of the horseshoe vortices have a significant influence on the accuracy of the computed surface pressure distribution. For greater accuracy, for a given chordwise number of horseshoe vortices, the transverse legs have to be longitudinally spaced according to the cosine distribution law

$$x_J^V - x_o = \frac{c}{2}\left[1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right] \tag{32}$$

where $x_J^V - x_o$ represents the distance from the leading edge to the midpoint of the swept leg of the Jth horseshoe vortex, c is the length of the local chord running through the midpoints of a given chordwise strip, and N is the number of horseshoe vortices per strip. The chordwise control point location corresponding to this distribution of vortex elements is given by

$$x_J^C - x_o = \frac{c}{2}\left[1 - \cos\left(\pi\,\frac{J}{N}\right)\right] \tag{33}$$

The control points are located along the centerline, or midpoint line, of the chordwise strip (fig. 4). Lan has shown (ref. 7) that the chordwise 'cosine' collocation of the lattice elements, defined by equations (32) and (33), greatly improve the accuracy of the computation of the effects due to lift. His results are directly extendable to the computation of surface pressure distributions of wings with thickness by the biplanar lattice scheme presented herein.

The small perturbation boundary condition

$$\bar{v} \cdot \bar{n}' = -\bar{u}_\infty \cdot \bar{n} \tag{34}$$

is applied at the control points. In equation (34), $\bar{n} = \ell\bar{i} + m\bar{j} + n\bar{k}$, and $\bar{n}' = m\bar{j} + n\bar{k}$, where $\ell$, m, and n are the direction cosines of the normal to the actual airfoil surface. Equation (34) implies that $|\ell u| \ll |mv + nw|$. The use of the small perturbation boundary condition is consistent with the present biplanar approach to the simulation of thick wings.

## Modeling of Fusiform Bodies

The modeling of fusiform bodies with horseshoe vortices requires a special concentrical vortex lattice if the simulation of the volume displacement effects, and the computation of the surface pressure distribution, are to be carried out. To define this lattice, it is necessary to consider first an auxiliary body, identical in cross-sectional shape and longitudinal area distribution to the actual body, with a straight baricentric line, i.e., without camber. The cross-sectional shape of this auxiliary body is then approximated by a polygon whose sides determine the transverse legs of the horseshoe vortices. The vertices of the polygon and the axis of the auxiliary body (which by definition is rectilinear (zero camber) and internal to all possible cross sections of the body) define a set of radial planes in which the bound trailing legs of the horseshoe vortices lie parallel to the axis (fig. 5). As the body cross section changes shape along its length, the corresponding polygon is allowed to change accordingly, but with the constraint that the polygonal vertices must always lie in the same set of radial planes. The axial spacing of the cross-sectional planes that determine the transverse vortex elements, or polygonal rings, follows the cosine law of equation (32). The boundary condition control points are located on the auxiliary body surface, and in the bisector radial planes, with their longitudinal spacing given by equation (33).

The boundary condition to be satisfied at these control points is the zero mass flux equation.

$$\overline{w} \cdot \overline{n} = - \overline{u}_{\infty} \cdot \overline{n} \tag{35}$$

where all the components of the scalar product $\overline{w} \cdot \overline{n} = \beta^2 \ell u + mv + nw$ are to be retained. Thus, equation (35) is a higher order condition than equation (34). The use of this higher order boundary condition, within the framework of a linearized theory, is not mathematically consistent. Therefore, it can only be justified by its results rather than by a strict mathematical derivation. In the present treatment of fusiform bodies, it has been found that the use of higher order, or exact boundary conditions is a requisite for the accurate determination of the surface pressure distribution.

The fact that the vector $\overline{w}$, instead of $\overline{v}$, appears in the left hand member of equation (35) requires some elaboration. First, it should be pointed out that for small perturbations $\overline{w} \cdot \overline{n} \cong \overline{v} \cdot \overline{n}'$. Furthermore, for incompressible flow ($\beta = 1$), the vector $\overline{w}$ is identical to the perturbation velocity $\overline{v}$. Consequently, the boundary condition equation (34) is consistent with the continuity equation, $\nabla \cdot \overline{w} = 0$, to a first order for compressible flow, and to any higher order for incompressible flow. But when a higher order boundary condition is applied in compressible flow to a linearized solution, it should be remembered that this solution satisfies the conservation of $\overline{w}$, not of $\overline{v}$, i.e., $\nabla \cdot \overline{w} = 0$. Thus, the higher order boundary condition should involve the reduced current velocity, or perturbation mass flux, vector $\overline{w}$, as in equation (35), rather than the perturbation velocity vector $\overline{v}$.

The body camber, which was eliminated in the definition of the auxiliary body, is taken into account in the computation of the direction cosines $\ell$, m, and n, which are implicit in equation (35). Therefore, the effect of camber is represented in the boundary condition but ignored in the spatial placement of the horseshoe elements. This scheme will give a fair approximation to cambered fusiform bodies provided that the amount of body camber is not too large.

## Computation of Sideslip Effects

The aerodynamics of an isolated wing in sideslip can be analyzed by two different approaches depending on the coordinate system chosen. In one approach, the coordinate system consists of wind axes, the longitudinal axis being aligned with the free-stream velocity vector, figure 6. This formulation of the problem is known as the skewed-wing approach, and a first order solution obtained within this framework will give the dominant effects of sideslip, even for the case of zero dihedral. The other approach, also shown schematically in figure 6 and known as the skewed free-stream approach, is based on a body-axis formulation of the problem and the corresponding first order solution, though it may be adequate for large dihedral, will fail to produce the significant effects of sideslip for low or zero dihedral. To compute the sideslip effects correctly within the framework of a skewed free-stream formulation, it is necessary to solve partial differential equations containing second order terms of the perturbation velocities. This implies a much more involved computational procedure than that required for the solution of the first order perturbation equations (1) On the other hand, the application of the skewed-wing approach to anything more complex than an isolated wing in sideslip, such as might be the case with a configuration with wing, fuselage, and nacelles, becomes geometrically very complicated.

The approach adopted herein is a combination of the two approaches mentioned above, formulated with the objective of obtaining reasonably accurate sideslip effects using only a first order perturbation solution but without all of the geometrical complications inherent in the skewed-wing approach. Basically it is assumed that the vortex lattice representing the configuration and its vortex wake consists of both bound and free elements or legs; the vortex filaments that model rigid surfaces are considered bound, and those that constitute the wake are the so-called free elements, figure 7. The bound portion of the lattice, containing both transverse and trailing, or chordwise, segments, is invariant in a body axis system, the chordwise legs being parallel to the x-axis. The free legs of the lattice are not actually force free, rather they are assumed to extend to downstream infinity parallel to a predetermined direction which is proportional to the angles of attack and sideslip. If the proportionality factors are unity, then the free portion of the lattice would be invariant in wind axes.

After the circulation strengths of the above lattice geometry are solved for under the appropriate boundary conditions, the pressure coefficient distribution is computed in accordance with the higher order expression

$$c_p = -\frac{2}{q_\infty^2}\left(U_\infty u + V_\infty v\right) \tag{36}$$

where $U_\infty$ and $V_\infty$ are the components along the x and y body axes of the free-stream velocity vector of modulus $q_\infty$; the corresponding perturbation velocity components are denoted by u and v, as usual. The use of equation (36) instead of the linear approximation

$$C_p = - \frac{2}{q_\infty^2} U_\infty u \qquad (37)$$

is required for the correct computation, within the present framework, of the rolling moment due to sideslip of a planar wing. This is due to the fact that the bound trailing legs, being defined in body axes, are not lined up with the free-stream flow and therefore, according to the theorem of Kutta, they contribute to the normal force. This contribution is represented by the second order term in equation (36), namely, $V_\infty v$. Even though this contribution is of second order, it must be included in the computation of the differential rolling moment due to sideslip, since this quantity itself is of the second order for a planar, or nearly planar, wing.

## THE GENERALIZED VORTEX LATTICE METHOD

### Description of Computational Method

The four items discussed in the preceding section, i.e., the inclusion of the vorticity-induced residual term $v^*$ for supersonic flow, the biplanar scheme for representing thickness effects, the use of a vortex grid of concentrical polygonal cylinders for the simulation of fusiform bodies, and the special lattice geometry consisting of both bound and free elements for the analysis of sideslip effects, have been implemented in a computational procedure herein known as the generalized vortex lattice (GVL) method. This method, outlined in what follows, has been codified in a Fortran IV computer program (VORLAX).

The basic element of the method is the swept horseshoe vortex whose trailing legs has both bound and free segments. The latter segments may trail to downstream infinity in any arbitrary, but predetermined, direction whereas the bound trailing legs are laid out on the proper cylindrical control surfaces in a direction which is parallel to the x body axis. Figure 8 illustrates schematically the representation of a wing-body configuration within the context of the present method. In this illustration, the streamwise arrangement of the lattice follows the cosine distribution law, equation (32), but both chordwise and spanwise distributions of vortex lines can be independently specified to be either of the cosine or of the equal spacing. To each horseshoe vortex there corresponds a control point which is placed midway between the bound trailing legs of the horseshoe; the longitudinal location of the control point is determined by equation (33) if the cosine chordwise distribution has been chosen, otherwise it is located halfway between the transverse legs, as required by quarter-chord/three-quarter-chord rule.

The direction of floatation of the wake vortex filaments is defined by the two angles $\sigma_v$ and $\beta_v$ shown in figure 8, the former being proportional to the angle of attack, and the latter being proportional to the sideslip angle. The proportionality constants are part of the program input, the recommended values being 0 for the sideslip constant, and 0 or 0.5 for the angle of attack constant.

The velocity field induced by the elementary horseshoe vortex is given by equations (27) when above constants are both zero, and by somewhat more complicated expressions which take into account the kinks in the trailing legs when either one or both of the wake floatation parameters are nonzero. Though not presented here, these expressions can be easily derived through the application of equations (23).

When the influence induced by a horseshoe vortex upon its own control point is being evaluated, the contribution from the generalized principal part, as given by equation (21), is included in the normalwash if the free-stream is supersonic. Furthermore, for the supersonic case, the simplified downwash formula, equation (30), is used whenever the receiving point is in the same plane of the inducing horseshoe.

The horseshoe vortex velocity field is used to generate the coefficients of a system of linear equations relating the unknown vortex strengths to the appropriate boundary condition at the control points. This linear system is solved by either a Gauss-Seidel iterative procedure, known as controlled successive over-relaxation (ref. 8), or by a vector orthogonalization technique, i.e., Purcell's vector method (ref. 9). If the inverse process is desired, i.e., synthesis or design instead of analysis, the linear system of equations is used to compute the slope distribution (surface warp) required to achieve a specified surface loading; this involves a straightforward matrix multiplication process. Mixed cases, i.e., design and analysis, are easily handled by proper grouping of the boundary condition equations.

The pressure coefficients are computed in terms of the perturbation velocity components, the computation being carried out according to either one of three possible ways, as follows:

1. If the surface under consideration is assumed wetted by the flow on both sides (zero thickness panel) and the configuration sideslip angle is zero, then a net loading coefficient is computed based on the local value of the spanwise vorticity, namely, $\Delta Cp = 2\gamma \cos\Lambda$;

2. When the configuration sideslip angle is not zero, the net loading coefficient of a zero-thickness surface is calculated through the use of the higher order expression (36); and

3. When surface pressure coefficients are computed, i.e., the panel under consideration is assumed wetted by the flow on one side only, the isentropic flow relationship giving the pressure coefficient in terms of free-stream Mach number and local-to-free-stream velocity ratio is resorted to.

The force and moment coefficients are calculated by numerical integration of the pressure coefficient distribution with due account being given to the edge forces. If cosine chordwise lattice spacing is specified by the VORLAX program user, the computation of the leading edge suction of zero thickness panels is carried out according to Lan's procedure (ref. 7), whose application to supersonic flow is made possible by the generalized vortex-induced velocity field formulas presented in this report. If equal chordwise lattice spacing is specified, the contribution of the leading edge suction singularity to the forces and moments is calculated by the technique indicated by Hancock in reference 10; this approach is not nearly as accurate as Lan's, the magnitude of the leading edge suction being significantly underestimated.

The VORLAX computer program has the capability of analyzing symmetrical and asymmetrical cases as well as configurations in steady state angular rotation about any or all of three axes, parallel to the coordinate axes, going through the input moment reference center. Steady state angular rotation cases are treated by the subterfuge of assuming a nonuniform onset flow, this onset flow being defined by the values of the angular rates and distance of the field point to the rotation center.

Ground proximity effects are analyzed by the method of images, i.e., the configuration is mirrored about the ground plane; the flow around the airplane and its image then contains a stream surface which coincides with the ground plane due to the symmetry of the arrangement. In this modeling of a configuration in ground proximity, it is assumed that the trailing vorticity wake floats to downstream infinity parallel to the plane of the ground.

## Numerical Considerations

At supersonic Mach numbers, the velocity induced by a discrete horseshoe vortex becomes very large in the very close proximity of the envelope of Mach cones generated by the transverse leg of the horseshoe. At the characteristic envelope surface itself, the induced velocity correctly vanishes, due to the finite part concept. This singular behavior of the velocity field occurs only for field points off the plane of the horseshoe. For the planar case, the velocity field is well behaved in the vicinity of the characteristic surface. A simple procedure to treat this numerical singularity consists of defining the characteristic surfaces by the equation

$$(x-x_1)^2 = C\,B^2 \left\{(y-y_1)^2 + (z-z_1)^2\right\} \tag{38}$$

where C is a numerical constant whose value is greater than, but close to, 1. It has been found that this procedure yields satisfactory results, and that these results are quite insensitive to reasonable variations of the parameter C.

Another numerical problem, peculiar to the supersonic horseshoe vortex, exists in the planar case (field point in the plane of the horseshoe) when the field point is close to a transverse vortex leg swept exactly parallel to the Mach lines (sonic vortex), while the vortex lines immediately in front of and behind this sonic vortex are subsonic and supersonic, respectively. This problem can be handled by replacing the boundary condition equation for such sonic vortex with the averaging equation

$$-\gamma_{I}{}^{*}{}_{-1} + 2\,\gamma_{I}{}^{*} - \gamma_{I}{}^{*}{}_{+1} = 0 \qquad (39$$

where $\gamma_I{}^*$ is the circulation strength of the critical horseshoe vortex, and $\gamma_I{}^*{}_{-1}$ and $\gamma_I{}^*{}_{+1}$ are the respective circulation values for the fore-and-aft adjacent subsonic and supersonic vortices.

The axialwash induced velocity component (u) is needed for the computation of the surface pressure distribution, and for the formulation of the boundary condition for fusiform bodies. When the field point is not too close to the generating vorticity element, the axialwash is adequately described by the conventional discrete horseshoe vortex representation. But if this point is in the close vicinity of the generating element, as may occur in the biplanar and in the concentrical cylindrical lattices of the present method, the error in the computation of the axialwash due to the discretization of the vorticity becomes unacceptable. This problem is solved by resorting to a vortex-splitting technique, similar to the one presented in reference 11. Briefly, this technique consists of computing the axialwash induced by the transverse leg of a horseshoe as the summation of several transverse legs longitudinally redistributed, according to an interdigitation scheme, over the region that contains the vorticity represented by the single discrete vortex. This is done only if the point at which the axialwash value is required lies within a given near field region surrounding the original discrete vortex.

## COMPARISON WITH OTHER THEORIES AND EXPERIMENTAL RESULTS

Conical flow theory provides a body of exact results, within the context of linearized supersonic flow, for some simple three-dimensional configurations. These exact results can be used as bench mark cases to evaluate the accuracy of numerical techniques. This has been done rather extensively for the GVL method, and very good agreement between it and conical flow theory has been observed in the computed aerodynamic load distribution and all force and moment coefficients. Only some typical comparisons are presented in this report, figures 9 through 12.

Finally, the capability of computing surface pressure distributions by the method of this paper is illustrated in figures 13 and 14.

## CONCLUDING REMARKS

The present vortex lattice method, in the form of a computer program, has the capability to calculate the aerodynamic load distribution at subsonic and supersonic Mach numbers for arbitrary nonplanar configurations. It has been found to be a very useful preliminary design tool, particularly when aircraft configurations whose mission requirements involve both subsonic and supersonic flight are considered. It is also capable of the inverse process, namely, the computation of the surface warp required to achieve a given load distribution. Correlation with experimental data and with results from other theories shows a good agreement not only in the overall force and moment coefficients due to lift, but also in the distribution of the load coefficients.

The schemes shown for the simulation of thickness and volume effects, which allow the computation of surface pressure distribution by using only vortex lattice singularities, appear adequate for most practical purposes, though experience in this respect is somewhat limited.

The treatment of sideslip cases by the present method does not require higher order solutions, as is necessary for the skewed free-stream approach, and it is not as geometrically complicated as the skewed-wing formulation. Yet the analysis of complex configurations in sideslip still requires care and caution due to the numerical anomalies that may result from the interaction among aircraft components, such as a horizontal tail or a body, and the "free" trailing legs of the horseshoe vortices.

Additional capabilities that can be added to the present computer code, and that would enhance the value of the method as a preliminary design tool include the following:

- Incorporation of an optimization algorithm based either on Lagrange multipliers or on a gradient method, to design the surface warp for minimum drag under specified constraints.
- Application of the technique of reference 11, or of some other adequate technique, for the simulation of jet exhaust effects, with particular attention to its extension to supersonic flow.
- Introduction of a design procedure for the calculation of the geometry required to achieve a given surface pressure distribution, i.e., synthesis of both camber and thickness. The biplanar vortex lattice simulation of a thick lifting surface is well suited for the development of such a design procedure when combined with an iterative scheme.

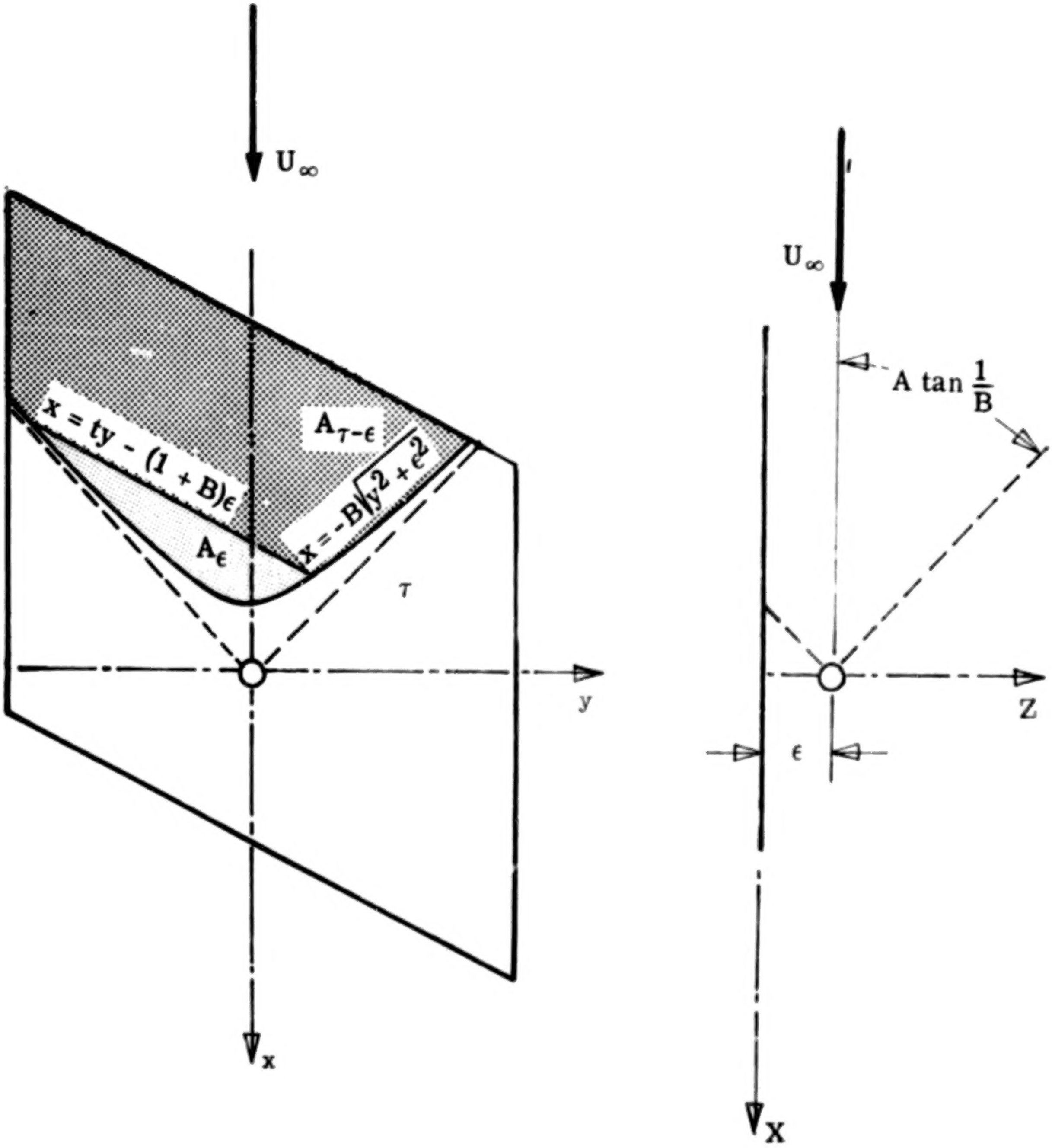

$U_\infty$
$A_{\tau-\epsilon}$
$x = ty - (1 + B)\epsilon$
$x = -B\sqrt{y^2 + \epsilon^2}$
$A_\epsilon$
$\tau$
y
x
$U_\infty$
$A \tan \frac{1}{B}$
Z
$\epsilon$
X

Figure 1.- Definition of integration regions for the computation of principal part.

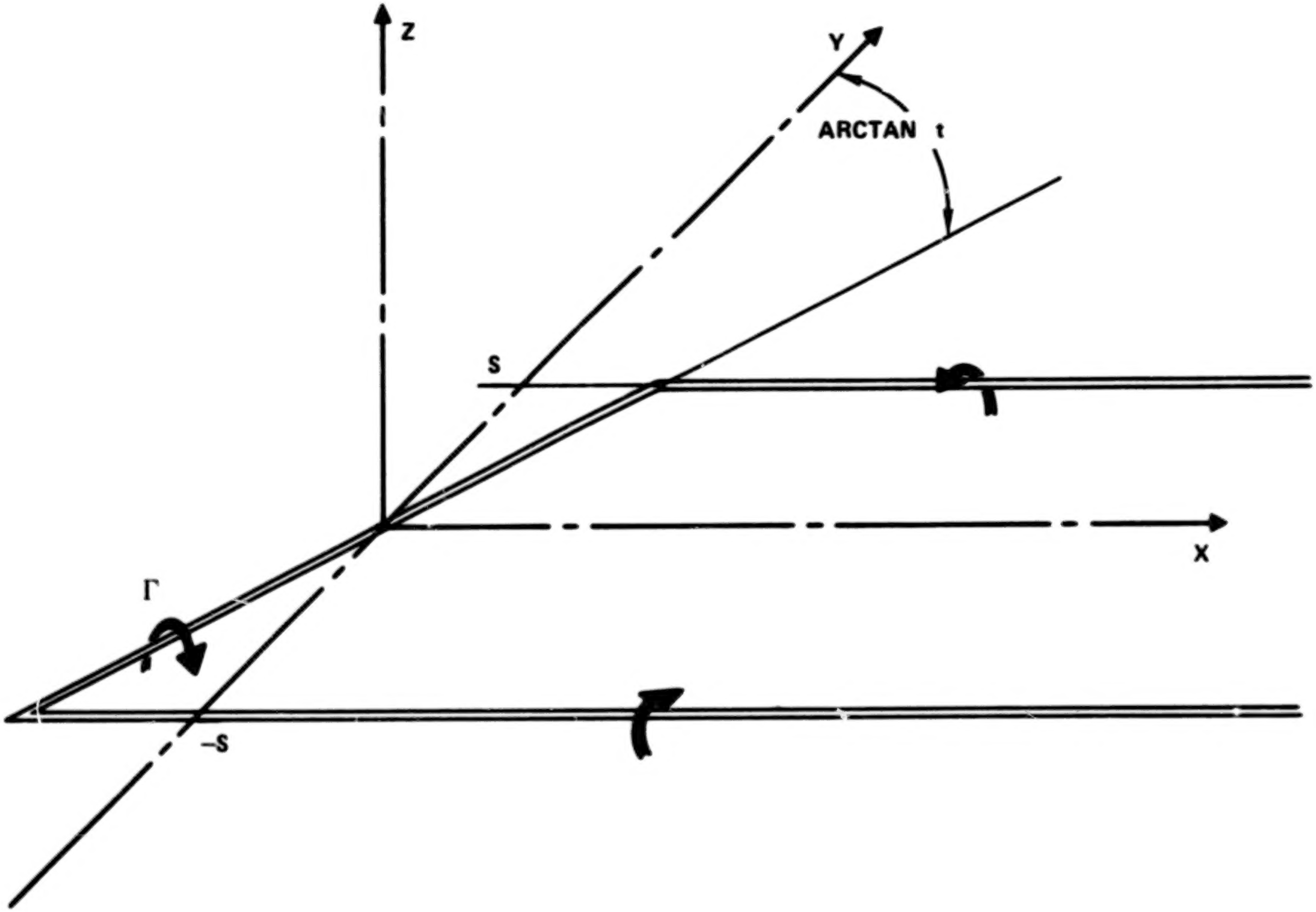
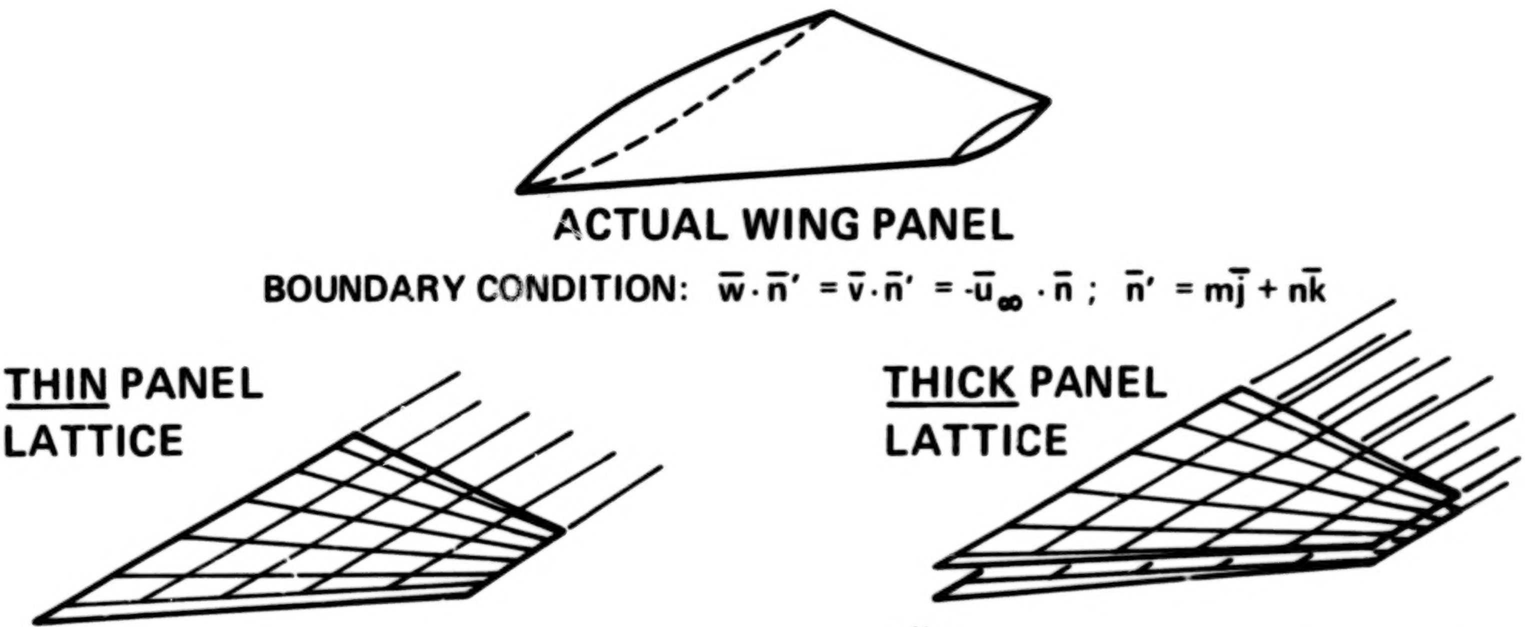

Z
Y
ARCTAN t
S
X
Γ
−S

Figure 2.- Sweptback horseshoe vortex


ACTUAL WING PANEL
THIN PANEL LATTICE
THICK PANEL LATTICE

BOUNDARY CONDITION: $\bar{w}\cdot\bar{n}' = \bar{v}\cdot\bar{n}' = -\bar{u}_{\infty}\cdot\bar{n}$ ; $\bar{n}' = m\bar{j} + n\bar{k}$

CHORDWISE DISTRIBUTION OF VORTEX LINES: $\dfrac{X_j^v - X_o}{C} = \dfrac{1}{2}\left\{1 - \cos\left(\pi\,\dfrac{2J-1}{2N}\right)\right\}$

CHORDWISE DISTRIBUTION OF B.C. CONTROL POINTS: $\dfrac{X_j^c - X_o}{C} = \dfrac{1}{2}\left\{1 - \cos\left(\pi\,\dfrac{J}{N}\right)\right\}$

Figure 3.- Modeling of thick wing with horseshoe vortices.

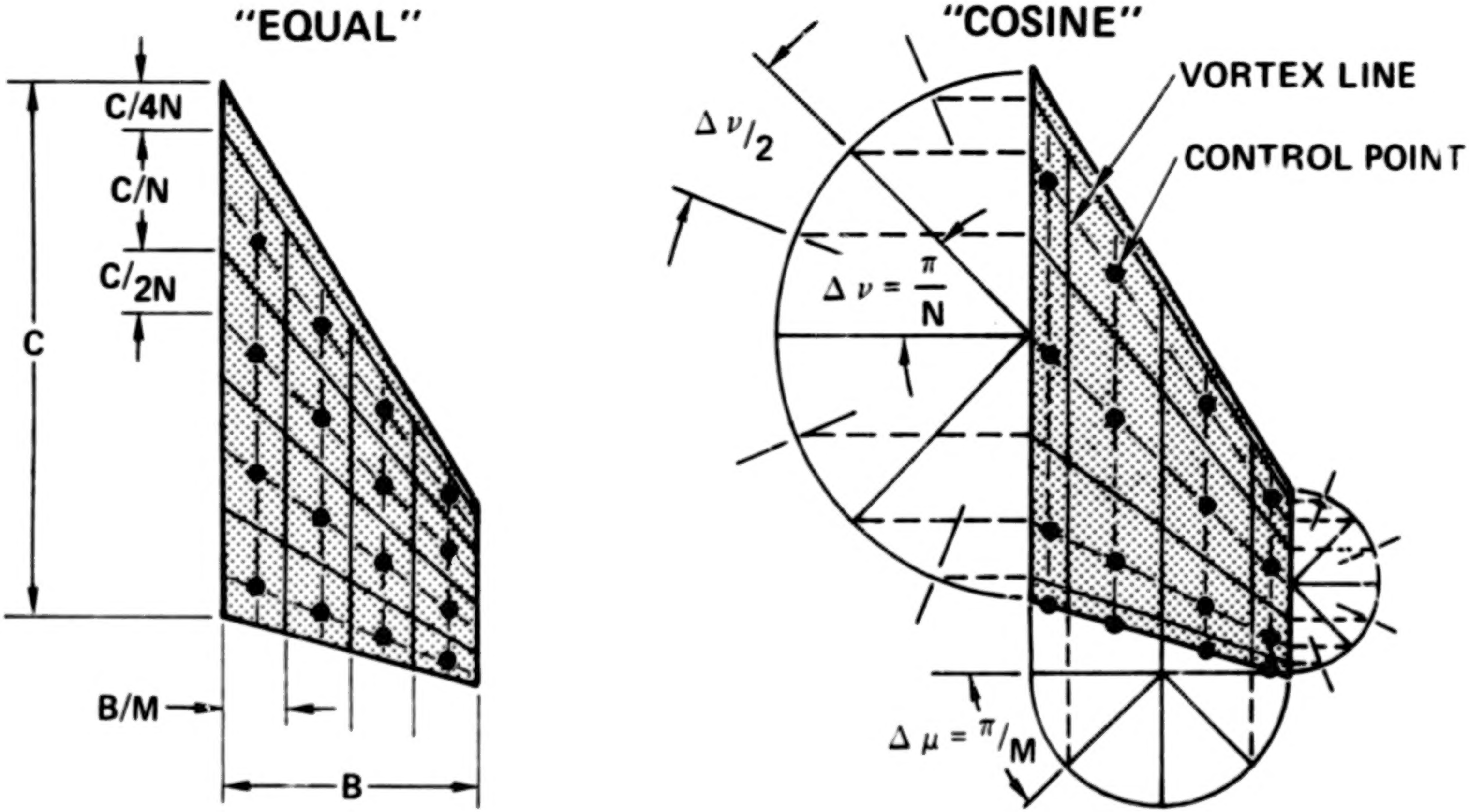
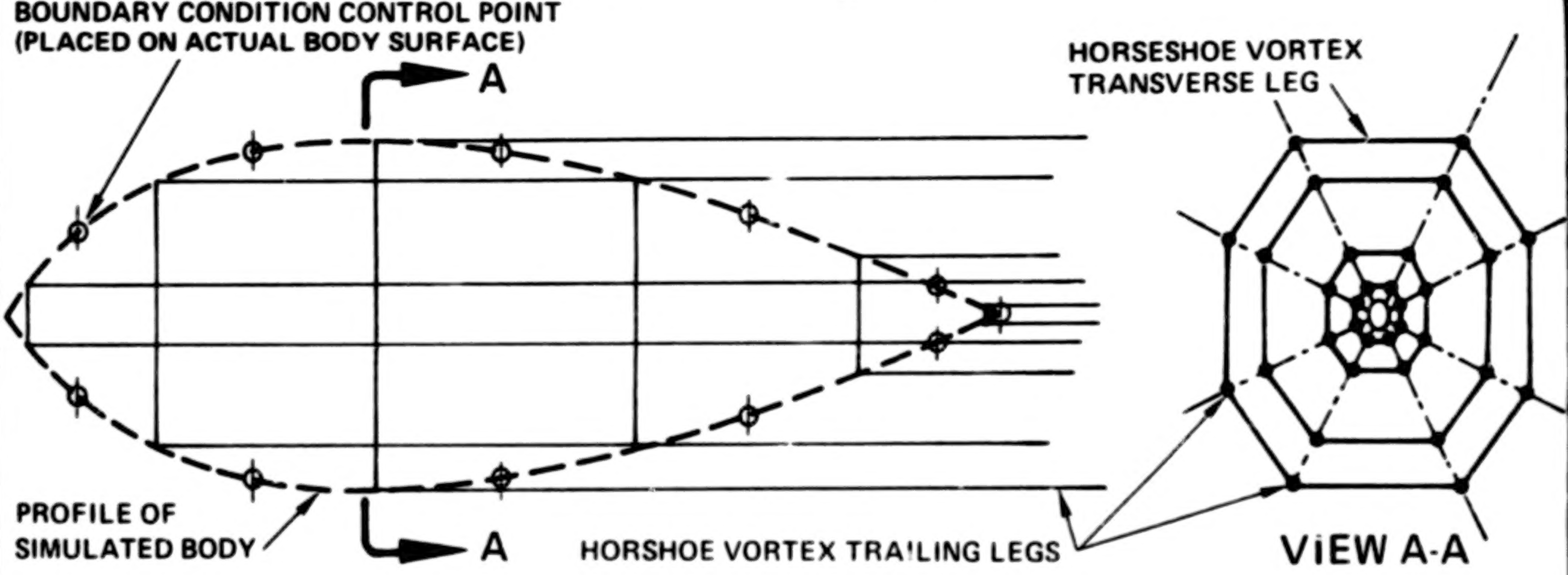

"EQUAL"
C/4N
C/N
C/2N
C
B/M
B
"COSINE"
VORTEX LINE
CONTROL POINT
Δ ν/2
Δ ν = π/N
Δ μ = π/M

Figure 4.- Vortex lattice collocation.

**BOUNDARY CONDITION:** $\bar{w}\cdot\bar{n} = -\bar{u}_{\infty}\cdot\bar{n}\ ;\ \bar{n} = \ell\,\bar{i} + m\,\bar{j} + n\,\bar{k}$


BOUNDARY CONDITION CONTROL POINT
(PLACED ON ACTUAL BODY SURFACE)
A
HORSESHOE VORTEX
TRANSVERSE LEG
PROFILE OF
SIMULATED BODY
A
HORSHOE VORTEX TRAILING LEGS
VIEW A-A

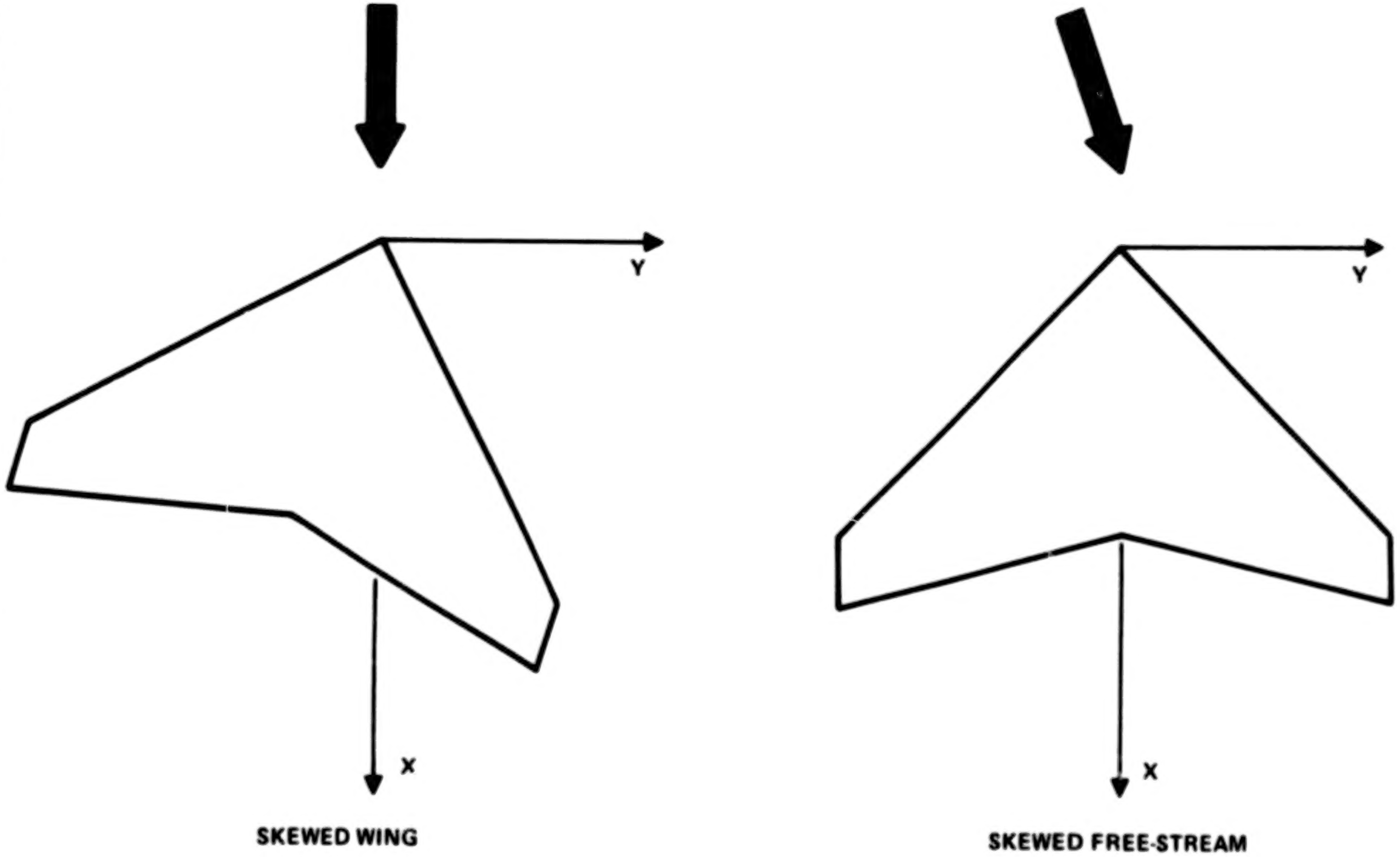
**AXIAL DISTRIBUTION OF VORTEX LINES:**

$$\frac{X_j^v - X_o}{L} = \frac{1}{2}\left|1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right|$$

**AXIAL DISTRIBUTION OF B.C. CONTROL POINTS:**

$$\frac{X_j^c - X_o}{L} = \frac{1}{2}\left|1 - \cos\left(\pi\,\frac{J}{N}\right)\right|$$

Figure 5.- Modeling of fusiform body with horseshoe vortices.



SKEWED WING

SKEWED FREE-STREAM

Figure 6.- Conventional approaches for analysis of wing in sideslip.

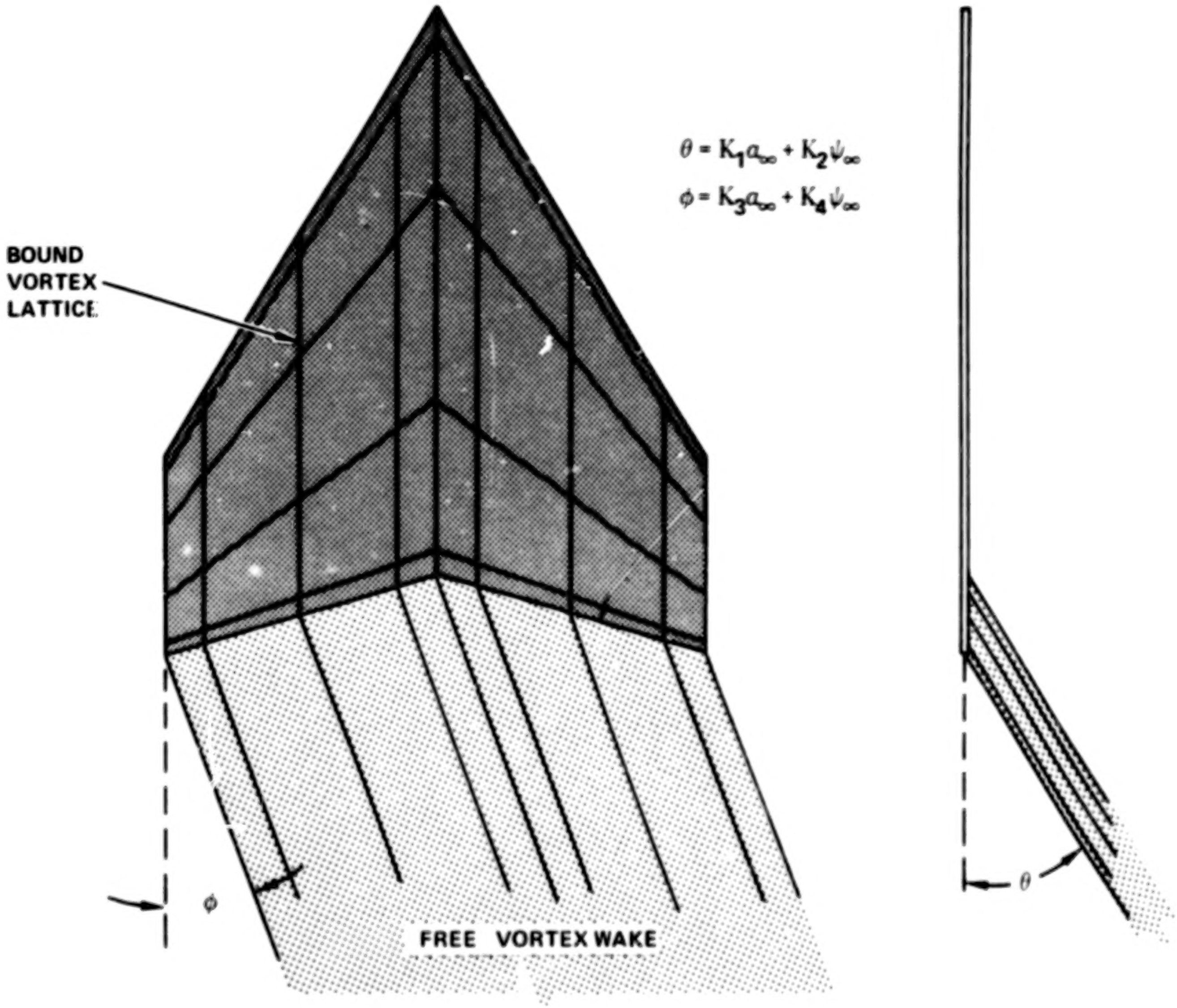

$\theta = K_1\alpha_\infty + K_2\psi_\infty$
$\phi = K_3\alpha_\infty + K_4\psi_\infty$
BOUND VORTEX LATTICE
$\phi$
FREE VORTEX WAKE
$\theta$

Figure 7.- Lattice geometry for analysis of wing in sideslip.

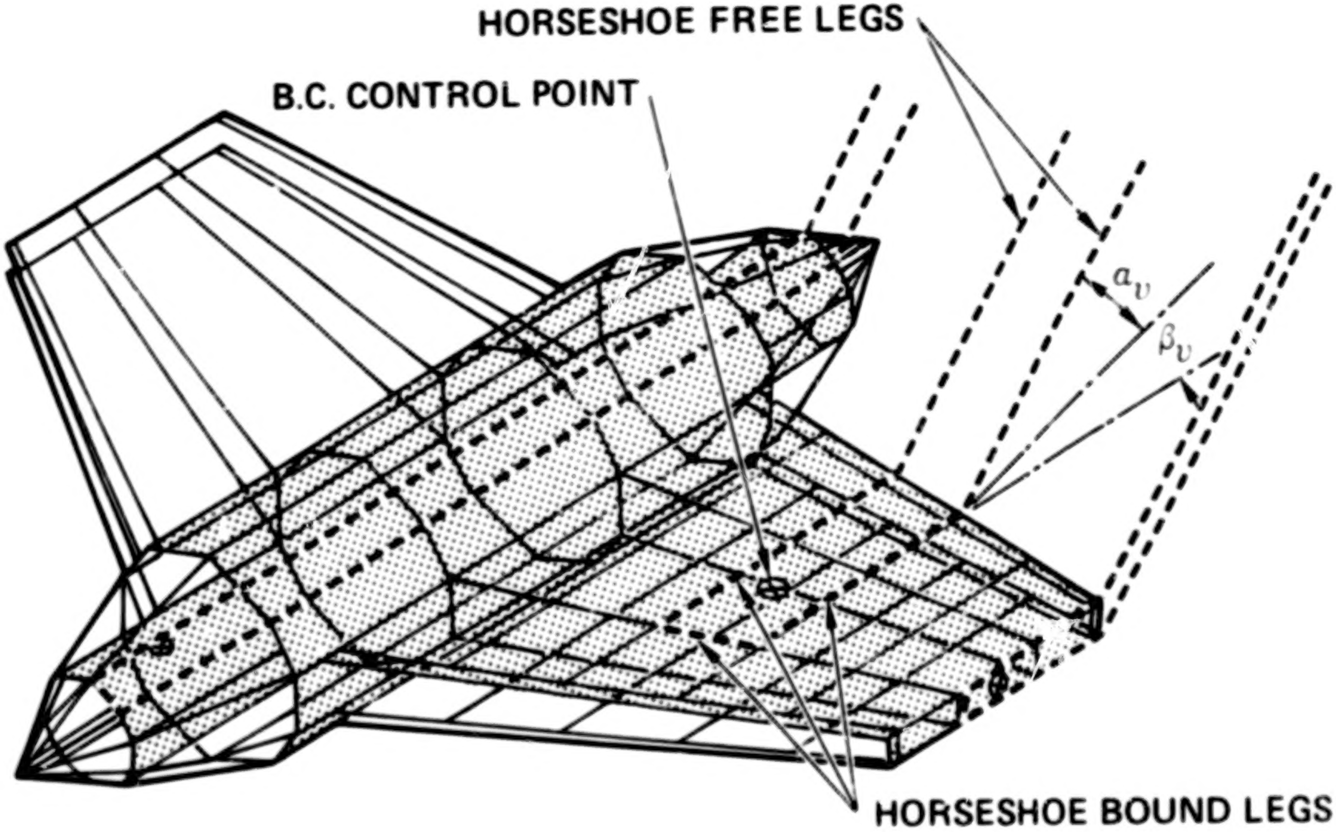

HORSESHOE FREE LEGS
B.C. CONTROL POINT
$a_v$
$\beta_v$
HORSESHOE BOUND LEGS

Figure 8.- Generalized vortex lattice model of wing-body configuration.

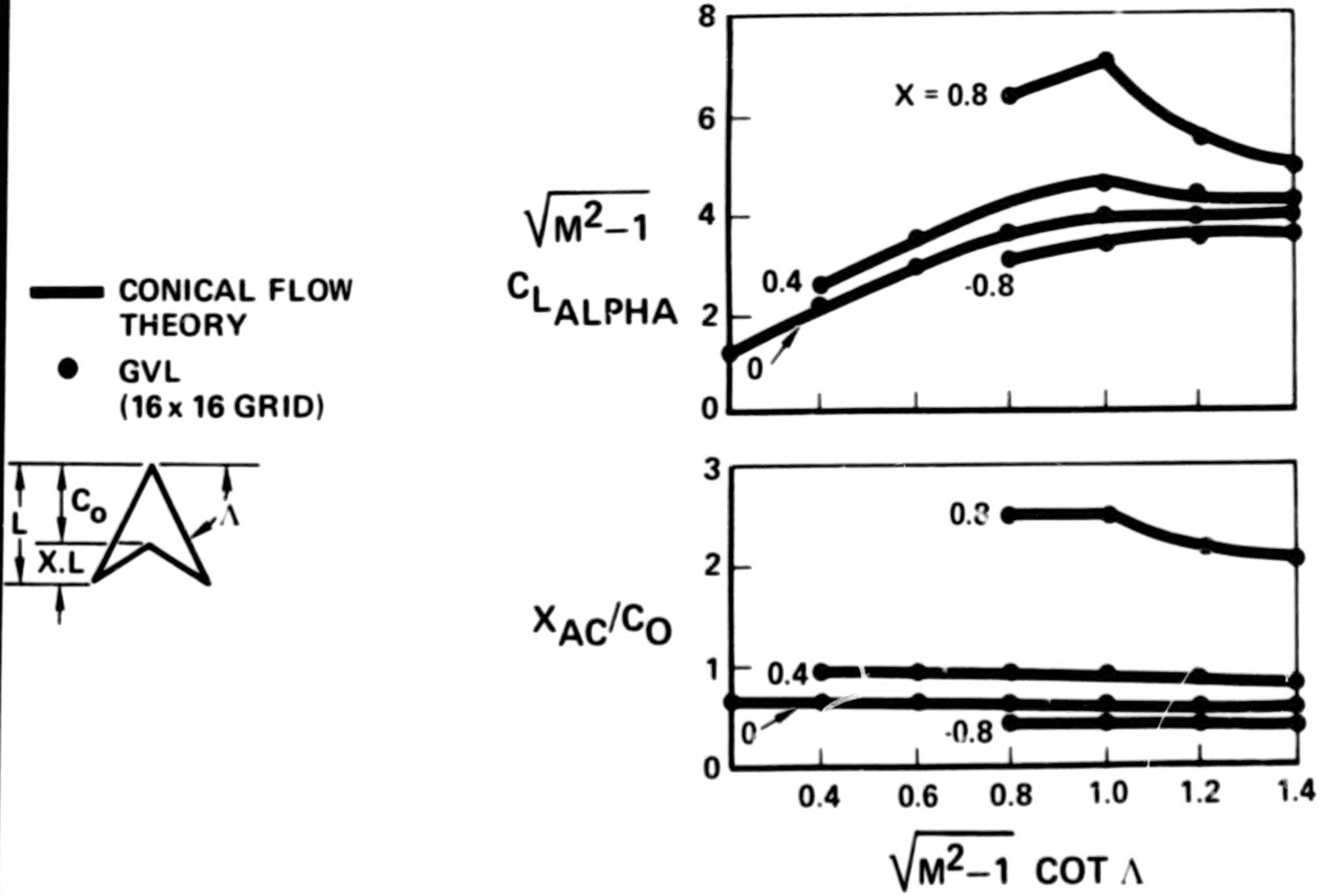


Figure 9.- Theoretical comparison of arrow wing lift slope and aerodynamic center location.

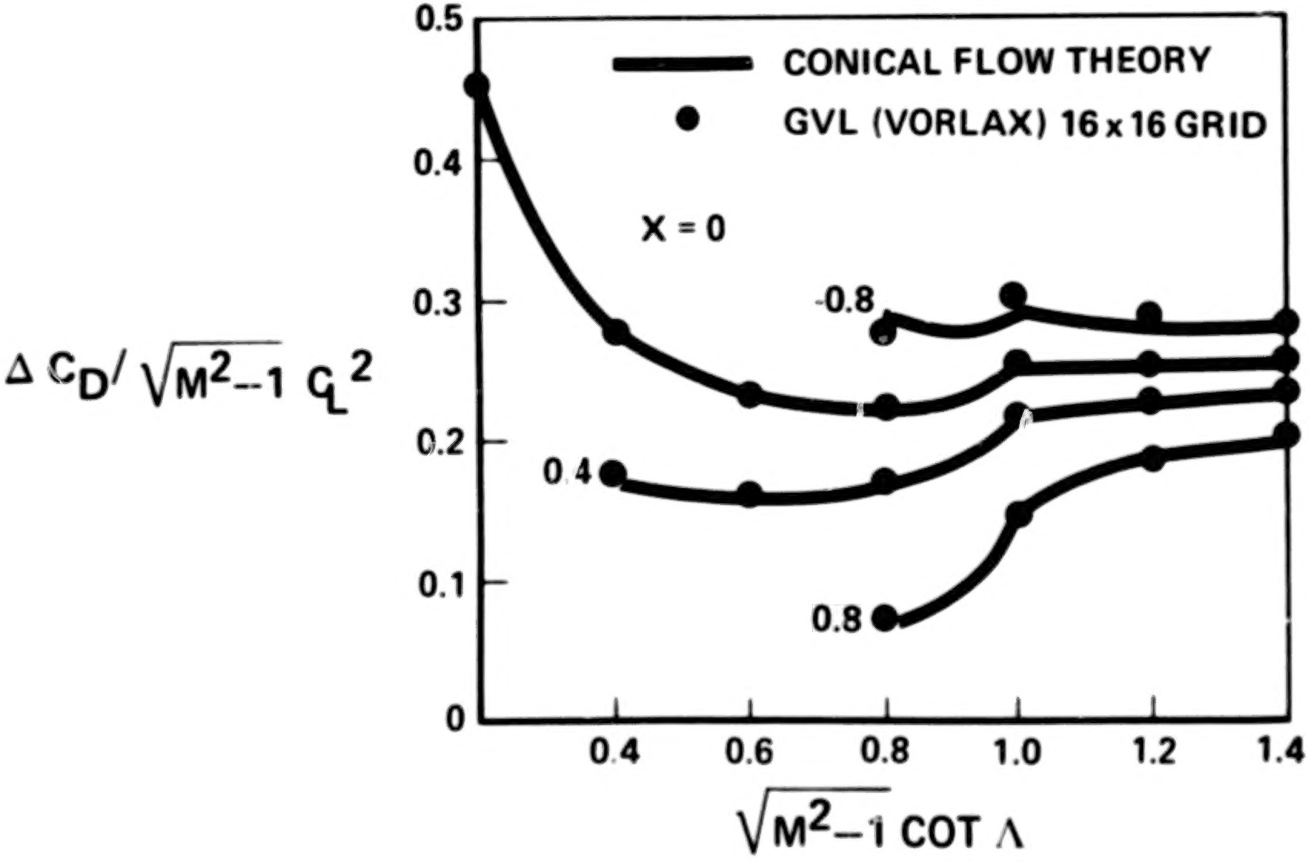


Figure 10.- Theoretical comparison of arrow wing drag-due-to-lift factor.

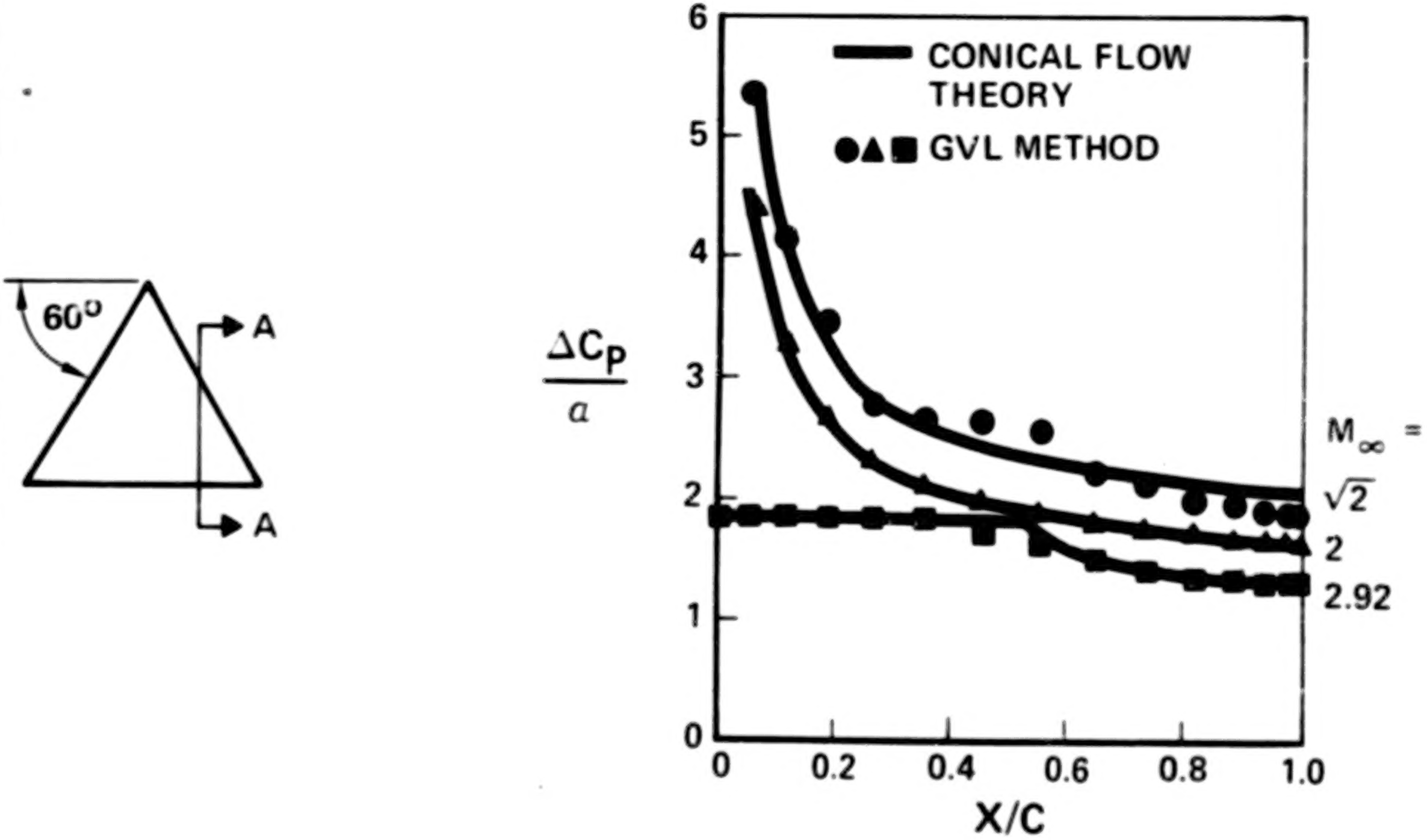
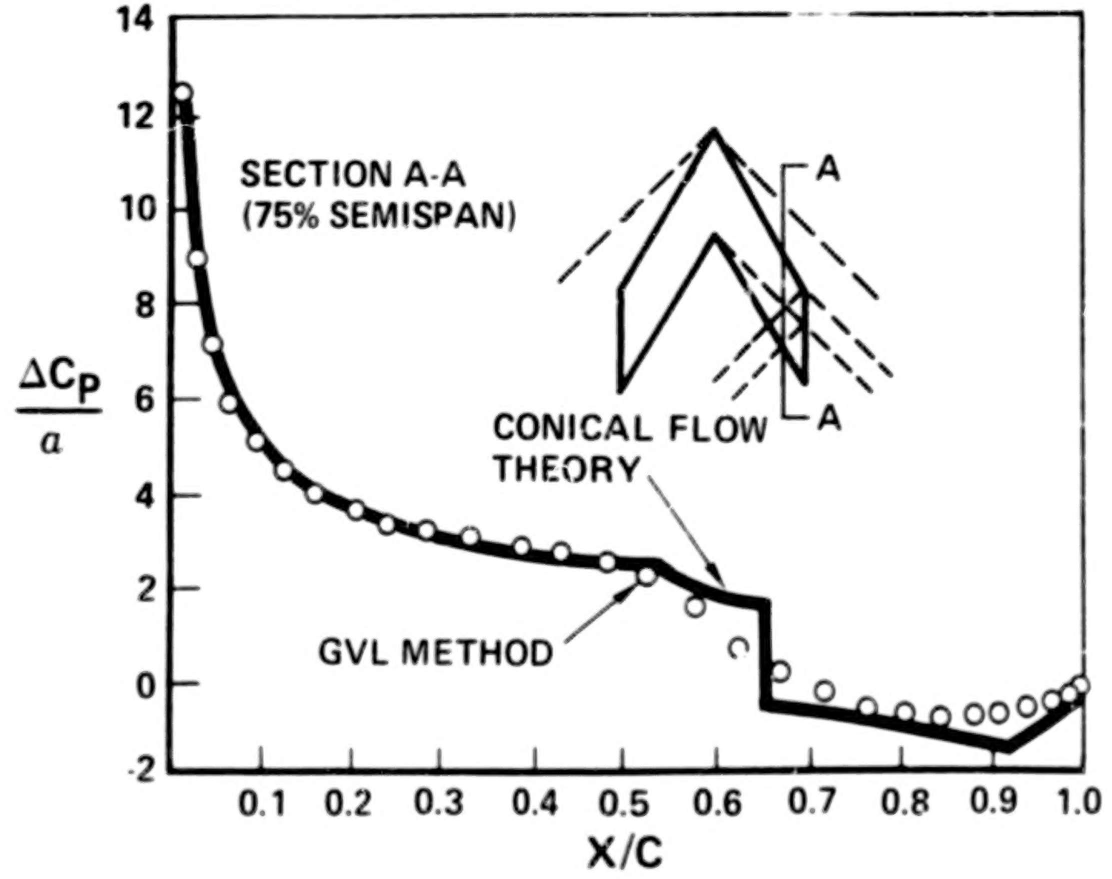


Figure 11.- Theoretical comparison of chordwise loading for delta wing.



SWEEP=59°; ASPECT RATIO = 1.92 MACH NUMBER= $\sqrt{2}$

Figure 12.- Theoretical comparison of chordwise loading for sweptback rectangular wing.

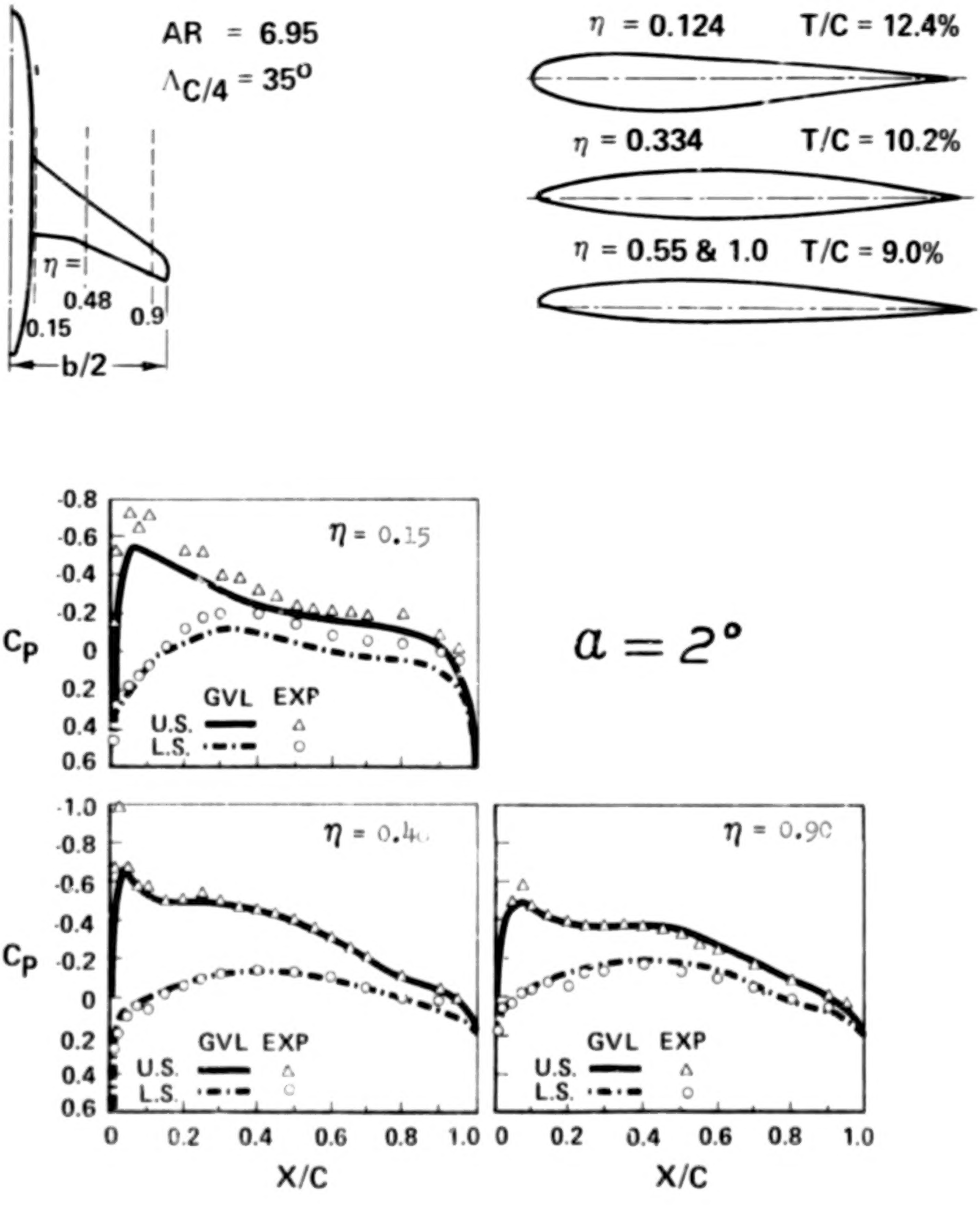


Figure 13.- Comparison with experimental pressure distribution on wing-body model at Mach = 0.5.

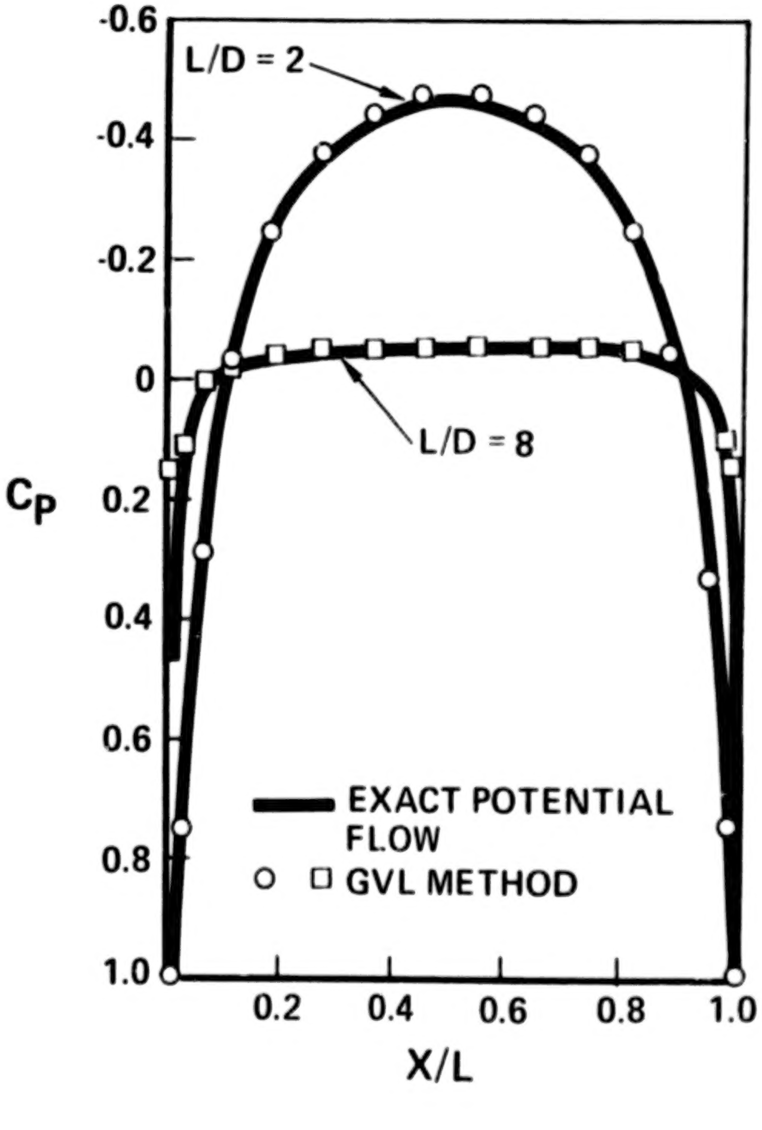


Figure 14.- Theoretical comparison of pressure distribution on ellipsoids at zero angle of attack in incompressible flow.

# APPENDIX A

# USER'S MANUAL
# FOR
# A GENERALIZED VORTEX LATTICE METHOD
# FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS

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# THE VORLAX COMPUTER PROGRAM

A computer program has been developed for the aerodynamic analysis and design of arbitrary aircraft configurations in subsonic and supersonic flow. This computer program, herein identified as VORLAX, has been codified in FORTRAN IV for use on the CDC 6600, the IBM 360, and the IBM 370 digital computer systems. A complete compilation and executed case in CDC FORTRAN IV is contained in Appendix B. Two auxiliary interface programs, treated in Appendices C and D, provide for input data transformation from NASA Wave Drag format (Reference 12) to VORLAX format (Appendix C) and for transformation from VORLAX to NASA Wave Drag format (Appendix D).

The VORLAX program is based on a generalized vortex lattice (GVL) method which extends the applicability of vortex lattice techniques to a broader range of problems than has heretofore been considered. In this program, the configuration is represented by a three-dimensional, generally nonplanar, vortex lattice; the basic element of the lattice is the skewed horseshoe vortex whose induced velocity formulas have been generalized for subsonic and supersonic flow. Thickness effects can be simulated by a double (biplanar or sandwich) lattice arrangement. Fusiform bodies can be modelled by a concentric cylindrical lattice of polygonal cross sections. The computational capabilities of the program include the following:

- Surface pressure or net load coefficient distribution.
- Aerodynamic force and moment coefficients.
- Surface warp (camber and twist) design in order to achieve input pressure distribution.
- Longitudinal/lateral stability derivatives.
- Ground and wall (wind tunnel interference) effects.
- Flow field survey.
- Symmetrical/asymmetrical configurations and/or flight conditions.

The limitations of the VORLAX program are characteristic of methods based on inviscid linearized potential flow theory, as follows:

- Attached flow.
- Small perturbation flow.
- Flow entirely subsonic or supersonic (no mixed transonic flow).
- Straight Mach lines.
- Rigid vortex wake.

# PRACTICAL INPUT INSTRUCTIONS

In defining a configuration for the program input, a master frame of reference X- Y- Z- is assumed. The X-Z plane is the centerline plane, the Z axis directed upward, and the X-axis pointing in the downstream direction; the Y axis points to starboard. The origin of the system can be any convenient point in the X-Z plane. In general, the configuration can be made up of symmetrical and asymmetrical components, and in defining the symmetrical components only the starboard elements need be specified.

The configuration to be input is divided into a set of major panels; up to 20 of these panels can be input, symmetrical components being counted only once. For instance, a wing with straight leading and trailing edges, and with linear lofting between the root and tip, constitutes a major panel. Complex planforms, and nonlinear changes in twist and airfoil sections are described by defining more than one panel for a given wing. The computer program will then subdivide each major panel into a number of smaller elementary panels spaced chordwise and spanwise, i.e., a finer mesh lattice is generated internally. The chordwise and spanwise spacing is specified by the user, two options being available: (1) the semicircle or cosine distribution so well known in airfoil and wing theory, and (2) the equally spaced distribution.

Up to 2000 elementary panels can be used in the definition of a given configuration. Any consistent system of length and area dimensions can be used in the specification of the configuration length, but it is recommended that the system of units used be such that the largest length dimension does not require more than three digits to the left of the decimal point. Otherwise, significant digits may be lost in the output printout.

Wing thickness effects can be taken into account within the context of control surface theory. By control surface theory one means that the exact linearized theory is used to evaluate induced velocities along a given mean surface, known as the control surface, and these values enter into the computation of the boundary conditions which are satisfied at this control surfac rather than at the actual boundary surface. The control surface equivalent of a typical two-dimensional airfoil is illustrated in figure A-1. The assumption inherent in control surface theory is that the induced velocities vary very little in the vicinity of the surface. Experience has shown that for the majority of practical configurations the loss in accuracy is negligible, and is more than compensated for by the increase in computational efficiency. Any wing-like component with thickness is then represented by a double set of panels, one for the upper surface and one for the lower surface as shown schematically in figure A-2.

All the swept horseshoe vortices, and their boundary condition control points, corresponding to a given surface, upper or lower, are located in a same plane. The upper and lower surface lattice planes are separated by a gap which represents the chordwise average of the airfoil thickness

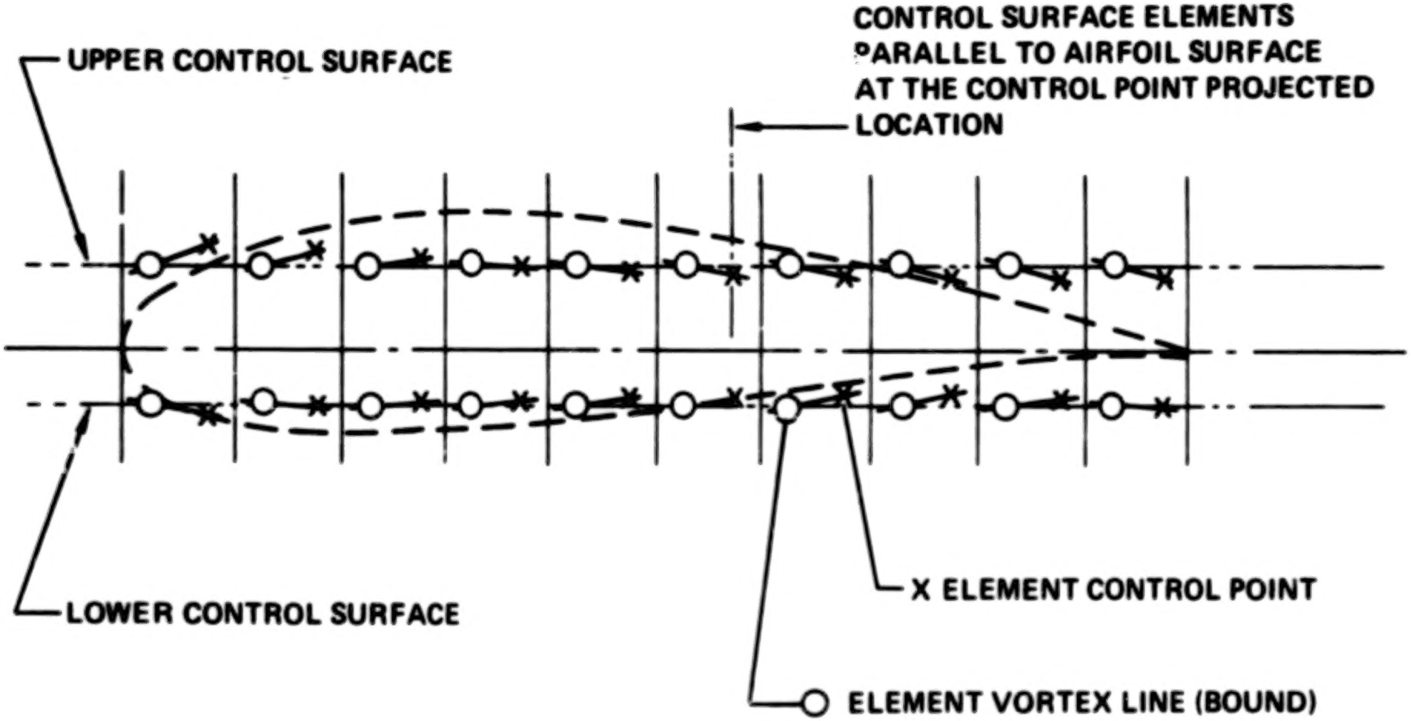
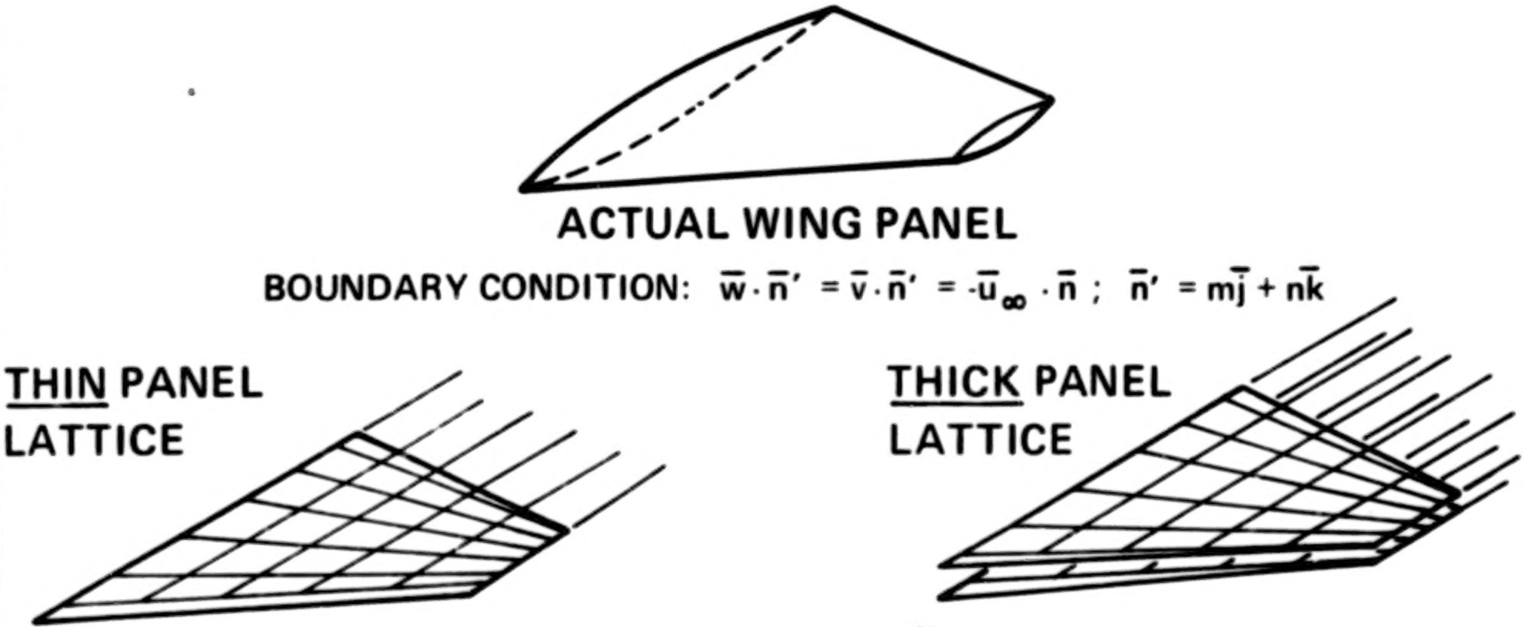

CONTROL SURFACE ELEMENTS PARALLEL TO AIRFOIL SURFACE AT THE CONTROL POINT PROJECTED LOCATION
UPPER CONTROL SURFACE
LOWER CONTROL SURFACE
X ELEMENT CONTROL POINT
○ ELEMENT VORTEX LINE (BOUND)

Figure A-1. - Control surface nomenclature


ACTUAL WING PANEL
THIN PANEL LATTICE
THICK PANEL LATTICE

BOUNDARY CONDITION: $\bar{w}\cdot\bar{n}' = \bar{v}\cdot\bar{n}' = -\bar{u}_\infty\cdot\bar{n}$ ; $\bar{n}' = m\bar{j} + n\bar{k}$

CHORDWISE DISTRIBUTION OF VORTEX LINES: $\frac{X_j^v - X_o}{C} = \frac{1}{2}\left\{1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right\}$

CHORDWISE DISTRIBUTION OF B.C. CONTROL POINTS: $\frac{X_j^c - X_o}{C} = \frac{1}{2}\left\{1 - \cos\left(\pi\,\frac{J}{N}\right)\right\}$

Figure A-2. - Modeling of thick wing with horseshoe vortices distribution. The results are not too sensitive to the magnitude of this gap; any value between one half to the full maximum chordwise thickness of the airfoil has been found to be adequate, the preferred value being two thirds of the maximum thickness. Furthermore, the gap can vary in the direction normal to the x-axis to allow for spanwise thickness taper. On the other hand, the chordwise distribution, or spacing, of the transverse elements of the horseshoe vortices have a significant influence on the accuracy of the computed surface pressure distribution. For greater accuracy, for a given chordwise number of horseshoe vortices, the transverse legs have to be longitudinally spaced according to the cosine distribution law

$$x_J^v - x_o = \frac{c}{2}\left[1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right]$$

where $x_J^v - x_o$ represents the distance from the leading edge to the midpoint of the swept leg of the Jth horseshoe vortex, c is the length of the local chord running through the midpoints of a given chordwise strip, and N is the number of horseshoe vortices per strip. The chordwise control point location corresponding to this distribution of vortex elements is given by

$$x_J^C - x_o = \frac{c}{2}\left[1 - \cos\left(\pi\,\frac{J}{N}\right)\right]$$

The control points are located along the centerline, or midpoint line, of the chordwise strip (figure A-3).

The modeling of fusiform bodies with horseshoe vortices requires a special concentric vortex lattice if the simulation of the volume displacement effects, and the computation of the surface pressure distribution, are to be carried out. To define this lattice, it is necessary to consider first an auxiliary body, identical in cross-sectional shape and longitudinal area distribution to the actual body, with a straight baricentric line, i.e., without camber. The cross-sectional shape of this auxiliary body is then approximated by a polygon whose sides determine the transverse legs of the horseshoe vortices. The vertices of the polygon and the axis of the auxiliary body, which by definition is rectilinear (zero camber) and internal to all possible cross sections of the body, define a set of radial planes in which the bound trailing legs of the horseshoe vortices lie parallel to the axis (figure A-4). As the body cross section changes shape along its length, the corresponding polygon is allowed to change accordingly, but with the constraint that the polygonal vertices must always lie in the same set of radial planes. As in the case of the biplanar representation of thickness effects, cosine axial spacing should be used for the analysis of fusiform bodies. The effect of body camber is taken into account by independently specifying the camber of the baricentric axis of the body.

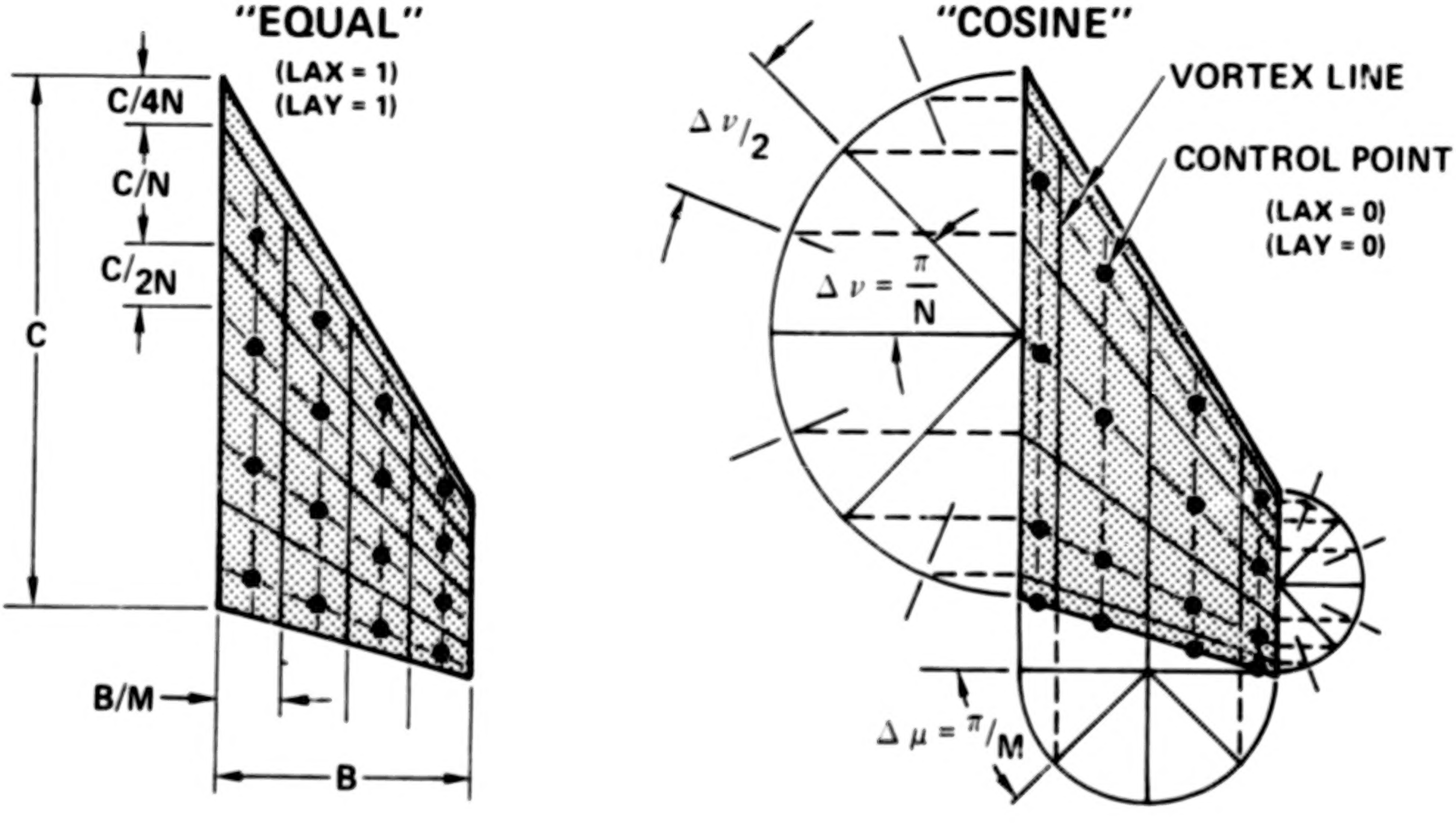
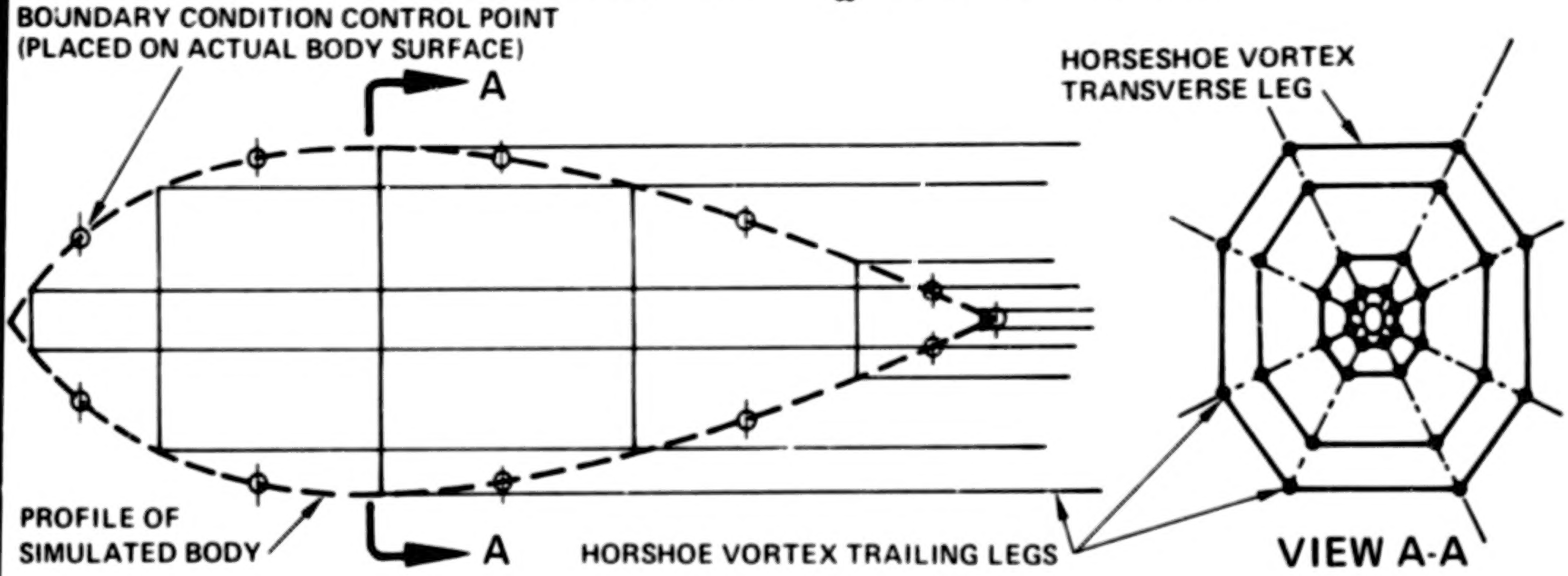

"EQUAL"
(LAX = 1)
(LAY = 1)
C/4N
C/N
C/2N
C
B/M
B
"COSINE"
VORTEX LINE
CONTROL POINT
(LAX = 0)
(LAY = 0)
Δ ν/2
Δ ν = π/N
Δ μ = π/M

Figure A-3. - Vortex lattice collocation

**BOUNDARY CONDITION:** $\bar{w}\cdot\bar{n} = -\bar{u}_{\infty}\cdot\bar{n}\ ;\ \bar{n} = \ell\,\bar{i} + m\,\bar{j} + n\,\bar{k}$


BOUNDARY CONDITION CONTROL POINT
(PLACED ON ACTUAL BODY SURFACE)
A
HORSESHOE VORTEX
TRANSVERSE LEG
PROFILE OF
SIMULATED BODY
A
HORSHOE VORTEX TRAILING LEGS
VIEW A-A

**AXIAL DISTRIBUTION OF VORTEX LINES:** $$\frac{X_j^v - X_o}{L} = \frac{1}{2}\left\{1 - \cos\left(\pi\,\frac{2J-1}{2N}\right)\right\}$$

**AXIAL DISTRIBUTION OF B.C. CONTROL POINTS:** $$\frac{X_j^c - X_o}{L} = \frac{1}{2}\left\{1 - \cos\left(\pi\,\frac{J}{N}\right)\right\}$$

Figure A-4. - Modeling of fusiform body with horseshoe vortices

## INPUT CARD IMAGE DESCRIPTION

The cards that constitute the input data deck are described in the following paragraphs. All format specifications are given in FORTRAN IV.

While some 19 cards are described, this does not mean that input for a case consists of 19 cards. Rather, these should be thought of as card types. Furthermore, not all card types will be included in a given case, those to be included or deleted being a function of some of the input values as shown in figure A-5.

| | | |
|---|---|---|
| CARD (1): | TITLE | In columns 1 through 80 write any alphanumeric identification heading. |
| CARD (2): | ISØLV | Method to be used for solving the system of linear equations relating the boundary conditions to the vorticity strength, in integer format, in column 2. ISØLV = 0: Gauss-Seidel relaxation with accelerated convergence (under- or over-relaxation); ISØLV = 1: Purcell's vector orthogonalization method. |
| | LAX | Chordwise, or streamwise, spacing of vortices, integer quantity punched in column 12, LAX = 0: vortices are collocated at the percent chord (X/C) values determined by the cosine law $X/C - 0.5 (1-\cos((2K-1) \pi/2N))$, where K varies between 1 and N, N being the number of chordwise vortices; LAX = 1: vortices are collocated according to the equally-spaced quarter-chord law $X/C = (4K-3)/(4N)$. The cosine law is recommended for greater accuracy for a given number of vortices. |
| | LAY | Spanwise, or lateral, spacing of vortices, integer quantity punched in column 22. LAY = 0: vortices are spaced at intervals (elementary vortex span) given by the cosine distribution law $\Delta b = b_p(\cos((J-1)\pi/M)-\cos(J\pi/M))/2$, where $\Delta b$ is the vortex element span, $b_p$ is the panel span, and J varies between 1 and M, M being the spanwise number of vortices in a given panel; LAY = 1: vortices are equally spaced along the panel span, i.e., $\Delta b = b_{p/M}$. The cosine spacing is recommended for enhanced accuracy, but |

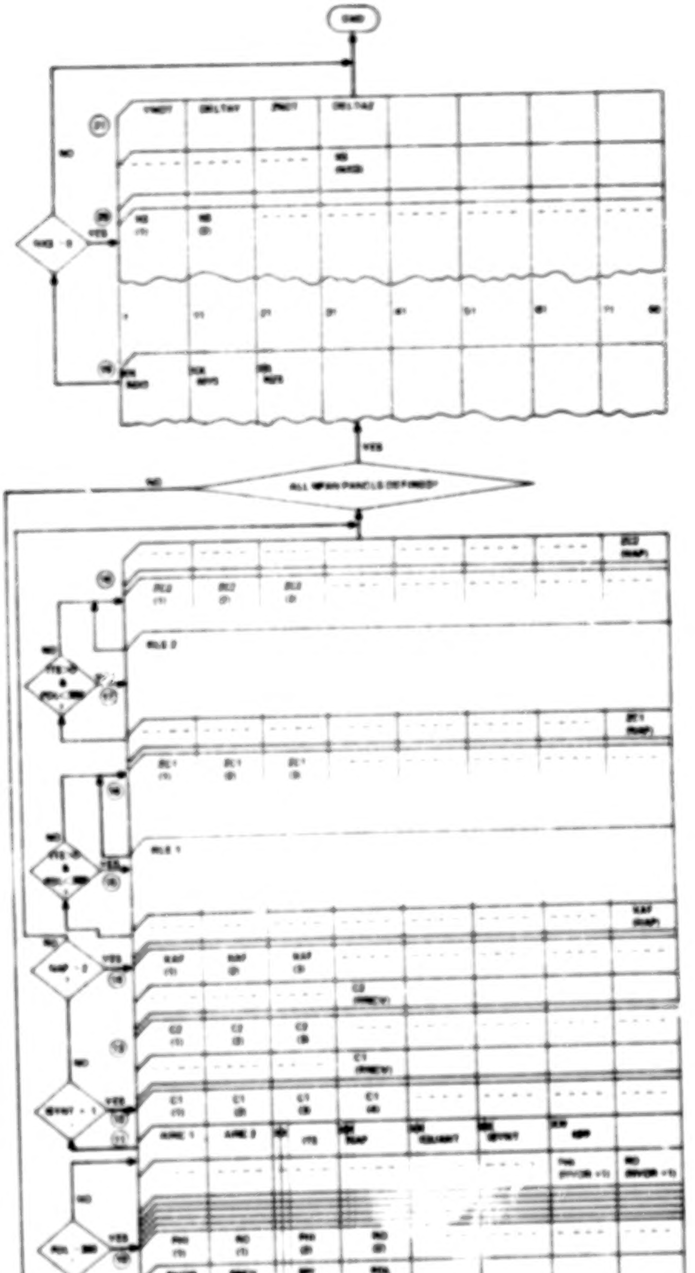

END
NO
YES
ALL NPAN PANELS DEFINED?
INPUT SEQUENCE
CARD TYPE
CARD COL (NN NOS)
TITLE
(ALPHANUMERIC)
ISOLVE
LAX
LAY
REXPAR
HAG
FLOATX
FLOATY
ALPHA
MACH
PB
PITCHQ
ROLLQ
YAWQ
SREF
CBAR
XBAR
ZBAR
WSPAN
X1
Y1
Z1
CORD 1
X2
Y2
Z2
CORD 2
NVOR
RNCV
SPC
PDL
AINC 1
AINC 2
C1
C2
RLE 1
RLE 2
1
11
21
31
41
51
61
71
80

Figure A-5. - VORLAX case data deck setup

| | |
|---|---|
| | for most cases the difference in the results between cosine spanwise spacing and even spanwise spacing is negligible. |
| REXPAR | Over-relaxation parameter, in F10.0 format starting in column 31. This parameter is intended to accelerate the Gauss-Seidel relaxation process, and/or make it convergen when it might otherwise diverge. Blank, or zero, input, implies that the program will compute internally the optimum over-relaxation value. If a positive quantity between 0.01 and 0.99 is input, this becomes the value of the over-relaxation parameter that the program will use, the optimum value being overridden. If ISØLV = 1, this parameter is not used, and therefore, not a required input quantity. |
| HAG | Height above ground of the moment reference center, in F10.0 format starting in column 41. If it is punched equal to zero, or left blank, the height above the ground is infinity, i.e., no ground effect. If a quantity different than zero is input, then the ground effect will be computed by the method of images, the height being given by the input value, in consistent units. |
| FLØATX | Longitudinal vortex wake flotation factor, in F10.0 format, starting in column 51. If zero, or blank, then the trailing vortex legs being shed from the corresponding trailing edges, extend to infinity parallel to the X-Y plane. If a value different from zero is input, then the trailing vortex legs shed from the trailing edges form an angle $\theta_v$=FLØATX·ALPHA with the X-Y plane, where ALPHA is the freestream angle of attack. (See figure A-6) |
| FLØATY | Lateral vortex wake flotation factor, in F10.0 format, starting in column 61. If zero or blank, then the trailing vortex legs being shed from the corresponding trailing edges extend to infinity parallel to the X-Z plane. If a value different from zero is input, then the vortex legs shed from the trailing edges form an angle |

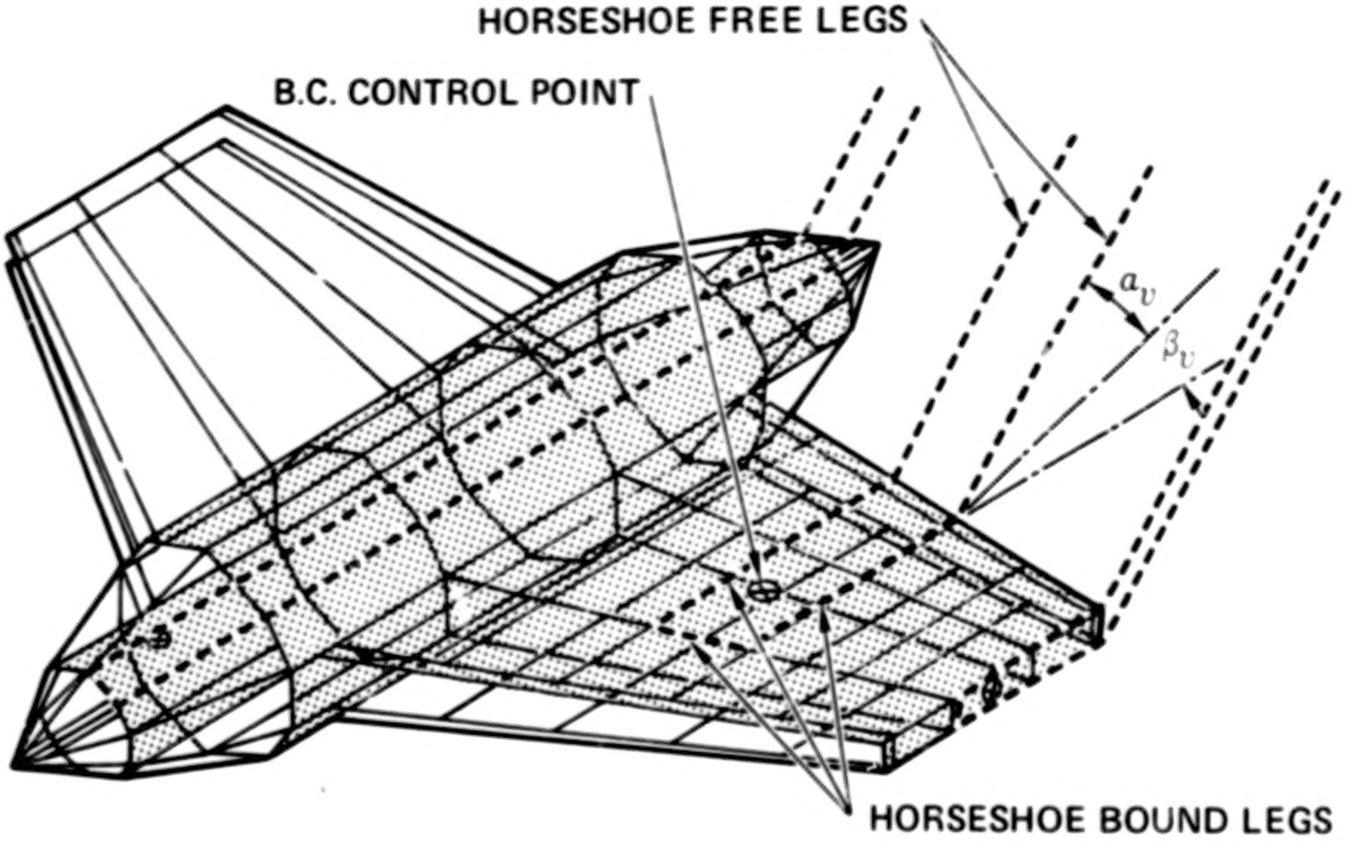

HORSESHOE FREE LEGS
B.C. CONTROL POINT
$a_v$
$\beta_v$
HORSESHOE BOUND LEGS

Figure A-6. Generalized vortex lattice model of wing body configuration

| | | |
|---|---|---|
| | | $\beta_v$ = FLØATY·BETA with the X-Z plan, where BETA is the freestream angle of slideslip (see figure A-6). |
| | ITRMAX | Maximum number of iterations allowed for the Gauss-Seidel relaxation method, in I3 format right-adjusted to column 80. If no value is input, the code will make ITRMAX = 99 by default. If ISØLV = 1, i.e., the vector orthogonalization solution is resorted to, then ITRMAX is not a required input. |
| CARD (3): | NMACH | Number of Mach numbers to be analyzed, in I2 format; i.e., integer value of NMACH in column 2. NMACH $\leq 7$. |
| | MACH | Mach numbers in F10.0 format starting in column 11. |
| CARD (4): | NALPHA | Number of angles of attack in I2 format; i.e., integer value of NALPHA in column 2. NALPHA $\leq 7$. |
| | ALPHA | Angles of attack in degrees in F10.0 format, starting in column 11. |
| CARD(5): | LATRAL | Asymmetric flight or configuration flag.<br>0 in column 2 = symmetric flight and symmetric configuration about the X-Z plane.<br>1 in column 2 = asymmetric flight and/or asymmetric configuration. |
| | PSI | Sideslip angle in degrees in F10.0 format starting in column 11. + = wind coming from left side of nose. Input 0. or blank when LATRAL is 0. Used to obtain static stability derivatives such as $C_{n_\beta}$, $C_{y_\beta}$, etc. |
| | PITCHQ | Pitch rate in degrees/second in F10.0 format starting in column 21. + = nose up pitch. Used to obtain dynamic stability derivatives such as $C_{m_q}$, $C_{L_q}$, etc. LATRAL may be 0 when PITCHQ is nonzero. |
| | RØLLQ | Roll rate in degrees/second in F10.0 format starting in column 31. + = left roll. Input 0. or blank when LATRAL is 0. Used to obtain dynamic stability derivatives such as $C_{\ell_p}$, $C_{n_p}$, etc. |

| | | |
|---|---|---|
| | YAWQ | Yaw rate in degrees/second in F10.0 format starting in column 41. + = left yaw or airstream component washing from left to right across nose of airplane. Input 0. or blank when LATRAL is 0. Used to obtain dynamic stability derivatives such as $C_{n_r}$, $C_{y_r}$, etc. |
| | VINF | Reference free stream velocity in F10.0 format starting in column 51. If no value is input, VINF is automatically set equal to 1.0 by the program. This parameter is only used when any of the angular rates is different from zero. It enters in the computation of the equivalent flow angle. For instance, if VINF = WSPAN/2 (wing semi-span) and ROLLQ = 5.73, then pb/2V = 0.1, and the rolling moment coefficient printed out by the program will be exactly one-tenth the value of the stability derivative $C_{\ell_p}$. Likewise, if VINF = CBAR/2 (half the mean aerodynamic chord) and PITCHQ = 5.73, then the difference between the output pitching moment coefficient and the pitching moment coefficient for the case PITCHQ = 0. will be equal to one-tenth of the $C_{m_q}$ derivative. |
| CARD (6): | NPAN | Number of major panels that will define the configuration, in I2 format; i.e., integer value of NPAN in columns 1-2 right adjusted to 2. NPAN $\leq 20$. |
| | SREF | Reference area for force and moment coefficients, in F10.0 format starting in column 11. |
| | CBAR | Pitching moment coefficient reference length, in F10.0 format starting in column 21. Usually mean aerodynamic chord length. |
| | XBAR | Abscissa of moment reference point, in F10.0 format starting in column 31. X-coordinate in master frame of reference. |
| | ZBAR | Ordinate of moment reference point, in F10.0 format starting in column 41. Z-coordinate in master frame of reference. |

| | | |
|---|---|---|
| | WSPAN | Total wing span in units consistent with SREF and CBAR, in F10.0 format starting in column 51. If left blank, a value of 2.0 will be assumed by the program. |
| CARD (7): | X1 | X or longitudinal coordinate of the leading edge of one side of a major panel. Usually taken as the most inboard side in the case of wings. Input in F10.0 format starting in column 1. |
| | Y1 | Y or lateral coordinate of leading edge of first side of a major panel. Input in F10.0 format starting in column 11. |
| | Z1 | Z or vertical coordinate of leading edge of first side of a major panel. Input in F10.0 format starting in column 21. |
| | CØRD1 | Chord length of first side of major panel measured from X1, Y1, Z1 above in the positive direction of, and parallel to, the X axis. |
| CARD (8): | X2 | X or longitudinal coordinate of the leading edge of the second side of the major panel described on card (7). Usually taken as the most outboard side in the case of wings. In the case of a closed curved panel, e.g., a cylindrical segment representative of a nacelle, X2 would be identical to X1. Input in F10.0 format starting in column 1. |
| | Y2 | Y or lateral coordinate of leading edge of second side of the major panel described on Card (7). Input in F10.0 format starting in column 11. |
| | Z2 | Z or vertical coordinate of leading edge of second side of the major panel described on Card (7). Input in F10.0 format starting in column 21. |
| | CØRD2 | Chord length of second side of major panel measured from X2, Y2, Z2 above in the positive direction of, and parallel to, the X axis. |

**Note:** Columns 41-80 of cards (7) and (8) are not read. Thus, any information useful for identification purposes may be written there.

Note that the side edges 1 and 2 of a major panel, which have just been described by the input in cards (7) and (8), define the direction of the positive normal for that panel. This is determined by the feet-to-head direction for an observer standing on the panel looking upstream (down the negative X-axis) and with panel edge 1 to his left, and panel edge 2 to his right. In this analogy it is assumed that gravity is not a factor in that an observer could be standing on the bottom of a wing, for example, equally as easily as he might stand on top. In the case of curved panels, such as a nacelle component, the direction of the positive normal loses its meaning for the panel as a whole, but it is still applicable to each one of the longitudinal, or chordwise, strips that make up the major panel.

| | | |
|---|---|---|
| CARD (9) | NVØR | Number of spanwise elements or vortices that will be used to represent the panel, in F10.0 format starting in column 1. NVØR ≤100.0. |
| | RNCV | Number of chordwise vortices that will be used to represent the panel, in F10.0 format starting in column 11. RNCV ≤50. The program, using NVØR and RNCV, will subdivide the panel under consideration into a grid of NVØR x RNCV swept horseshoe vortices collocated in accordance with the values of the LAX and LAY parameters. Note that chordwise and lateral distributions are independent, e.g., a cosine chordwise spacing (LAX=0) is compatible with equal spanwise distribution (LAY = 1), and vice versa. The corresponding control points at which the boundary conditions are satisfied are collocated according to the law $(X/C)_{control} = 0.5\ (1-\cos\ (K\pi/N))$, K varying between 1 and N, where N is the number of chordwise vortices, if LAX = 0. If LAX = 1, then the control points are placed at $(X/C)_{control} = (4K-1)/(4N)$, namely, according to the equally spaced three-quarter chord distribution. The spanwise location of the control points is always at the centerline of the elementary swept horseshoe vortices.<br>To determine the surface slope at each element control point, the program uses straight line element lofting between the two longitudinal, or butt line, edges of the major panel. |

In addition to the above limitations to the values of NVØR and RNCV, if more than one major panel is used in the description of the configuration, the following should be observed:

$$\text{If LATRAL=0,}\quad \sum_{1}^{\text{NPAN}} \text{NVØR} \times \text{RNCV} \le 2000$$

$$\text{If LATRAL=1,}\quad \sum_{1}^{\text{NPAN}} \text{NVØR} \times \text{RNCV} \times \text{IQUANT} \le 2000$$

IQUANT being defined further down.

| | | |
|---|---|---|
| | SPC | Leading edge suction multiplier, in F10.0 format starting in column 21. 0. = no suction. 1. = 100 percent leading edge suction. Nonzero values are recommended for all panels whose leading edges are wetted by the airstream. The program has the capability of computing the effects of free leading edge vorticity (leading edge vortex flows) by a localized application of the Polhamus analogy. This computation is triggered by inputting the SPC parameter as a negative quantity. When this is done, the sectional leading edge suction vector will be rotated normal to the camber surface at the leading edge, instead of the corresponding attached-flow tangential orientation, and the forces and moments will be computed using the rotated suction vector. |
| | PDL | Planar/curved panel flag, in F10.0 format starting in column 31. 0. = planar major panel is to be described (including warped planar.) PDL = 999. (or >360.) = a curved major panel is to be described. |
| CARD (10): | PHI | Polar coordinate angle of radius vector when defining the subpaneling of a curved major panel. Omit this card when PDL = 0. PHI is the angle measured from the horizontal in a plane parallel to the Y-Z plane. PHI = 0 coincides with a line parallel to and in the positive direction of the Y-axis. Positive values of PHI are measured counterclockwise when viewed from the rear of the aircraft. |

| | | |
|---|---|---|
| | | PHI is input in F10.0 format starting in column 1. This and the subsequent input RO constitute a polar coordinate pair. The number of pairs to be input = NVØR + 1. Four pairs per card may be input in F10.0 format starting in column 1. As many cards as necessary are used. While the location of the origin from which the polar angle, PHI, is arbitrary the first PHI, RØ polar coordinate pair must coincide with the Y1, Z1 rectangular coordinates input on Card (7). Likewise, the last input polar pair must coincide with the Y2, Z2 of Card (8). |
| | RØ | Radius vector from arbitrary origin when defining the subpaneling of a curved major panel. Input in F10.0 format. Each RØ is part of a PHI, RØ polar coordinate pair. |
| CARD (11): | AINC1 | Tangent of the angle subtended by major panel root chordline, or first edge (described in Card (7)), and the positive X-axis, in F10.0 format starting in column 1. Sign convention is determined by observing the edge 1 chordline and the X-axis from edge 2. The edge 1 chord is then rotated counterclockwise until it is parallel to the X-axis. If the angle rotated through is less than 90 degrees then the angle, and consequently its tangent, are considered positive. If it is greater than 90 degrees, then AINC1 is negative. |
| | AINC2 | Tangent of the angle subtended by major panel tip chordline, or second edge (described in Card (8)), in F10.0 format starting in column 11. Sign convention is determined by observing edge 2 and the X-axis, looking in the direction from edge 2 toward edge 1. The edge 2 chord is then rotated counterclockwise until it is parallel to the X-axis. If the angle rotated through is less than 90 degrees, then the sign is positive; otherwise it is negative. |
| | ITS | Surface flag input as a two place integer in columns 21 and 22, right-adjusted to column 22. ITS = 0 or blank indicates that the panel is considered as a lifting surface of zero thickness, i.e., both its upper and |

| | |
|---|---|
| | lower surface are wetted by the external flow. ITS = 01 means that only the panel upper surface is wetted by the real external flow. ITS = -1 indicates that only the panel lower surface is wetted by the real external flow. A double panel setup can then be used to represent a wing-like component with non-zero thickness, as previously illustrated in Figure 2. Notice that the X1, Y1, Z1, X2, Y2, and Z2 values to be input correspond to the control surface plane, and not to the actual chordal plane. The results are not critically sensitive to the separation between the upper surface panel (ITS = 01) and the lower surface panel (ITS = -1), a separation of two thirds the thickness ratio of the airfoil being a good average value to use. |
| NAP | Number of percent chords or stations along the chord (CØRD1 and CØRD2) at which the camber, or surface, ordinates are to be input. Input as a two-place integer in columns 31 and 32, right-adjusted to column 32. Maximum value of NAP is 50. A NAP = 0, 1, or 2 will be interpreted as a flat wing and no subsequent camber cards will be expected. If ISYNT, on this same card, is to be input as 1, i.e., a design case, then NAP should be 0 or blank. |
| IQUANT | Symmetry flag with respect to X-Z plane input as an integer in column 42. IQUANT = 0 or 2 indicates there is a mirror image of the panel on the opposite side of the X-Z plane. IQUANT = 1 indicates the panel is unique to the side for which it is being input. |
| ISYNT | Design/analysis flag input as an integer in column 52. ISYNT = 0 or blank indicates that the panel has been defined geometrically and only analysis is to take place. ISYNT = 1 indicates that the panel camber is to be designed by the program to support a specified pressure distribution. If NAP on this same card was input >2, then ISYNT should be zero or blank. |

| | | |
|---|---|---|
| | NPP | Nonplanar parameter, input as on integer in column 62. NPP = 0 indicates that all the vortex filaments representing a given surface lie in the cylindrical surface whose directrix is the leading edge of the panel, and whose generatrices are all parallel to the X-axis. NPP = 1 denotes that the transverse vortex. filaments are located on the actual body surface, but the bound trailing legs are parallel to the x-axis. This parameter affects the definition of $ZC_1$ and $ZC_2$ on cards 16 and 18. |
| CARD (12): | C1 | Pressure coefficients along the first, or root, edge of major panel defined on Card (7). If ISYNT = 0, then this card is omitted. Units are dimensionless, $\Delta p/q$. Format is 8F10.0 starting in column 1 with as many cards as necessary to input RNCV values of C1.<br>The desired values of the aerodynamic loading are defined at the chordwise location of the vortex lines. Thus, if LAX = 0, the corresponding X/C points follow the cosine distribution $(1-\cos((2K-1)\pi/2N))/2$; if LAX = 1, then the definition points are located by the law $(4K-3)/4N$. In the above expressions K ranges between 1 and N, N being equal to RNCV, the chordwise number of vortices. |
| CARD (13): | C2 | Pressure coefficients along the second, or tip edge of major panel defined on card (8). If ISYNT = 0, then this card is omitted. Format is 8 F10.0 starting in column 1 with as many cards as required to input RNCV values of C1. Linear interpolation between corresponding values of C1 and C2 is used to obtain $\Delta C_p$ at intermediate spanwise values for the subpanels. |
| CARD (14): | XAF | Chord percent values at which camber, or surface ordinates will be supplied for the major panel, in 8F10.0 format starting in column 1 using as many cards as necessary to define NAP values of XAF. If NAP is 0, 1, or 2, then a flat uncambered surface is implied and this card is omitted. These chord percents |

need not be equally spaced, but the same set applies to both the root and tip chords, or edges of the panel. Second order Lagrange or sliding parabola interpolation is used to interpolate between input XAF points to obtain the surface slope value at the control point of each subpanel.

For a panel representing the surface of a non-zero thickness airfoil or body, ITS ≠ 0, the Lagrange interpolation is modified to a fractional power (1/2) Lagrange method in the neighborhood of the leading edge. This allows the precise definition of the surface slopes at the control points for a blunt leading edge.

| | | |
|---|---|---|
| CARD (15): | RLE1 | Leading edge radius, in percent chord, of airfoil section at the first, or root, edge of panel, in F10.0 format between columns 1 and 10. This card exists only if ITS ≠ 0, PDL < 360.0 and NAP > 2. i.e., an airfoil with non-zero thickness is being simulated. Otherwise, it must be omitted. |
| CARD (16): | ZC1 | Camber ordinates or surface ordinates of root chord of the major panel described on Card (7) in units of percent chord, in 8F10.0 format, using as many cards as necessary to input NAP values, each corresponding to an XAF of the Card (14) series. Omit this card if NAP is 0, 1, or 2. If a lifting surface, such as a wing, is being simulated by a zero thickness panel then the ordinates of the wing camber line should be input here. If the wing thickness is being simulated by the sandwich or biplanar, method, i.e., a separate panel for upper and lower surfaces, then the surface ordinates for upper or lower should be input here. If a curved panel is being simulated (i.e., PDL > 360.) and NPP = 0 then ordinates of the panel streamwise edge should be input. These might represent the mean line of a shaped cowl for a flow through nacelle, for example. In this simulation all shed vortices will lie in the same cylindrical surface determined by the leading edge of the curved panel and the X direction. If NPP = 1 |

| | | |
|---|---|---|
| | | and PDL > 360.0, the ZC1 array represents the camber of the body axis. |
| CARD (17): | RLE2 | Leading edge radius, in percent chord, of airfoil section at the second, or tip, edge of panel, in F10.0 format between columns 1 and 10. This card exists only if ITS $\neq$ 0, PDL < 360.0 and NAP > 2, otherwise it must be omitted. |
| CARD (18): | ZC2 | Camber ordinates, or surface ordinates of the second, or tip chord of the major panel, or area ratios of the major panel in 8F10.0 format, using as many cards as necessary to input NAP values, each corresponding to an XAF of the Card (14) series. Omit this card if NAP is 0, 1, or 2. Linear spanwise interpolation is used to obtain intermediate values.<br>If a curved panel is being simulated (PDL > 360.) and NPP = 1 then area ratios in percent are expected here. These should represent the ratio of the cross sectional area of the closed polygonal surface being simulated at the XAF station under consideration divided by the area of the reference polygon times 100. Note that ZC2 is entered in percent where a value of 100 represents a section exactly the size of the reference polygon. Values greater or less than 100 are permitted down to and including 0. The reference polygon is that input via the PHI-RO pairs on Card 10. In this simulation it is presumed that all stations along the panel have the same shape as the reference polygon, and the transverse vortices are located on the actual body surface of the curved panel. |

This concludes the input for the first major panel of the configuration. If there is more than one panel, then start over with Card (7) and work down to this point. Panels may be input in any sequence.

After the last panel is described, continue with Card (19).

| | | |
|---|---|---|
| CARD (19): | NXS | Number of X-stations that will define the spatial flow field survey grid. NXS = 00 means no survey desired. Maximum value of NXS is 20. Input as a two-digit integer in columns 1 and 2, right-adjusted to column 2. |

| | | |
|---|---|---|
| | NYS | Number of Y-stations that will define the butt line values of the survey grid. NYS = 00 for no survey. NYS and NZS (following) may be any positive integer subject to NXS x NYS x NZS ≤2000.<br>Input as a two digit integer in columns 11 and 12. |
| | NZS | Number of Z-stations that will define the water line values of the survey grid. NZS = 00 for no survey. Input as a two digit integer in columns 21 and 22. |
| CARD (20): | XS | X station values for the spatial flow field grid. Omit this card if NXS=0. Input in 8F10.0 format starting in column 1, using as many cards as necessary to define NXS values. |
| CARD (21): | YNØT | Beginning of grid in the butt line direction. Input in F10.0 format starting in column 1. Omit this card if NXS = 0. |
| | DELTAY | Y-spacing of the grid. There will be NYS butt line planes equally spaced a distance DELTAY apart. Input in F10.0 format starting in column 11. |
| | ZNØT | Beginning of grid in the water line direction. Input in F10.0 format starting in column 21. |
| | DELTAZ | Z-spacing of the grid. There will be NZS water line planes equally spaced a distance DELTAZ apart. Input in F10.0 format starting in column 31. |

This ends the input description for a single case.

Consecutive data sets or cases can be submitted at the same time. The program will always identify the presence of a new set by the corresponding title card (Card (1)).

## PROGRAM OUTPUT

The program output is processed by a standard 132 characters-per-line printer. The output from each configuration is preceded by a printout of the input data cards. This printout is not an exact image of the input deck; rather, it is the version of the deck as the code sees it, namely, the default value of an input parameter is printed if there is a corresponding blank in the input card. Also, data within a format field are lined up for clarity in identification, even though in the input deck such data may be arbitrarily located within its field. The input deck data is followed by a list of the major geometric parameters used by the program and generated from the input data deck. Next, the component and total force and moment coefficients are printed out for a given flow condition (Mach number, angle of attack, angle of sideslip, and rotational velocities). These are followed by a tabulation of the location of all the vortex elements, the pressure coefficients, the circulation strengths, and other ancillary information. If a flow field survey about the configuration has been requested, then the flow parameters (velocity components, flow angles, Mach number, and pressure ratios) at a series of field grid points will be listed. If other flow conditions have been analyzed, the same type of output will follow for each one of them, starting with the listing of the component and total force and moment coefficients. If other configurations have been input, then the output will continue with the listing of the corresponding input data deck, and so on. Rather than describing the output format in detail, a glossary of the output terms, arranged in sequential order of appearance, and a sample computer output, Table A-1, are presented.

| | |
|---|---|
| I | Numbering index for major panel identification. For cases where LATRAL = 1, the I-number preceded by a double asterisk in the PANEL GEOMETRY list denotes that the panel is the mirror image (about the X-Z axis) of the panel with the same I-number but without asterisks. |
| XAPEX | =XI (see input terminology). |
| YAPEX | =Y1 (see input terminology). |
| ZAPEX | =Z1 (see input terminology). |
| PDC | =PDC (see input terminology). |
| LESWP | Sweep of the panel leading edge, in degrees. Positive for sweepback, negative for sweep forward. |
| CSTART | =CØRD1 (see input terminology). |
| TAPER | Panel taper ratio, CØRD2/CØRD1. |

| | |
|---|---|
| PSPAN | Panel span. |
| NVØR | =NVØR (see input terminology). |
| RNCV | =RNCV (see input terminology). |
| SPC | =SPC (see input terminology). |
| SURF | Panel surface area. |
| CN | Panel normal force coefficient, referenced to its own surface area. |
| CL | Panel lift coefficient, wind axes, referenced to its own surface area. |
| CY | Panel lateral force coefficient, wind axes, referenced to its own surface area. |
| CD | Panel drag coefficient, wind axes, referenced to its own surface area. |
| CT | Panel leading edge thrust coefficient, referenced to its own surface area. |
| CS | Panel leading edge suction coefficient referenced to its own surface area. |
| CM | Panel pitching moment about moment reference center divided by (freestream dynamic pressure X SURF), wind axes. |
| CRM | Panel rolling moment about moment reference center divided by (freestream dynamic pressure X SURF), wind axes. |
| CYM | Panel yawing moment about moment reference center divided by (freestream dynamic pressure X SURF), wind axes. |
| SREF | =SREF (see input terminology). |
| WSPAN | =WSPAN (see input terminology). |
| CBAR | =CBAR (see input terminology). |
| CLTØT | Total (summation over all panels) lift coefficient referenced to SREF. |
| CDTØT | Total pressure drag coefficient, referenced to SREF. |
| CYTØT | Total lateral force coefficient, wind axes, referenced to SREF. |

| | |
|---|---|
| CMTØT | Total pitching moment coefficient about moment reference center, wind axes, referenced to SREF and CBAR. |
| CRTØT | Total rolling moment coefficient about moment reference center, wind axes, referenced to SREF and WSPAN. |
| CNTØT | Total yawing moment coefficient about moment reference center, wind axes, referenced to SREF and WSPAN. |
| E | Oswald's efficiency factor. |
| S | Perimetral, or spanwise, index of vortex element. |
| C | Chordwise, or streamwise, index of vortex element, 1 denotes leading edge element, and C value equal to RNCV corresponds to the last, or trailing edge element. |
| X/C | Percent chord location of bound vortex line. |
| X, Y, Z | Coordinates of horseshoe vortex element centroid (center point of bound vortex line). |
| CHØRD | Local chord length. |
| SLØPE | Surface slope at boundary control point. |
| ITS | Flag which indicates type of panel surface (see input terminology). A zero value means that the panel is considered as a zero thickness lifting surface. A positive unit value (1) denotes that the panel is the upper surface of an airfoil-like element. A negative unit value (-1) corresponds to the lower surface. In the case of body-like components, 1 denotes the external, or wetted, surface. For a flow-through nacelle arrangement, 1 stands for the external surface, and -1 for the internal surface. |
| DCP | Local loading coefficient ($\Delta C_p = C_{p\ell} - C_{pu}$) if panel ITS = 0. If ITS $\neq$ 0, then DCP is the local pressure coefficient ($C_p$). |
| CNC | Sectional normal force coefficient times local chord. |
| CN | Sectional normal force coefficient. |
| DL | Local dihedral, in degrees. |
| CMT | Sectional pitching moment coefficient about local quarter chord. |
| GAMMA | Vortex element circulation strength, divided by freestream velocity. |
| ZC/C | If the design option is being invoked, the resulting surface warp is printed out instead of GAMMA. This surface warp is expressed in fraction of the local chord, and it includes both camber and twist. |
| CTC | Sectional thrust coefficient times local chord. |

| | |
|---|---|
| CDC | Sectional pressure drag coefficient times local chord. |
| ITRMAX | Maximum allowable number of relaxation cycles if Gauss-Seidel solution is used (see input terminology). |
| EPS | Tolerance, or minimum, iteration change for relaxation process. |
| ITER | Actual number of relaxation cycles. |
| BIG | Actual iteration change for relaxation process. Relaxation will stop when BIG $\le$ EPS, or when ITER = ITRMAX. |

If a flow field survey about the configuration has been requested (NXS > 0 in the input deck, see input description), then the following parameters will also be output as part of this survey:

| | |
|---|---|
| X, Y, Z | Coordinates of the survey grid points (not to be confused with the X, Y, Z coordinates of the vortex centroids previously described), referenced to the configuration master coordinate frame. The X, Y, Z coordinates are determined by the XS, YNOT, DELTAY, ZNOT, DELTAZ input values (see input terminology). |
| U | Dimensionless velocity (freestream velocity at infinity assumed to be unity) along the X-direction (body axes). |
| V | Dimensionless velocity along the Y-direction (body axes). |
| W | Dimensionless velocity along the Z-direction (body axes). |
| EPSLØN | Upwash angle in degrees. this angle is measured with respect to the X-axis in a plane parallel to the X-Z plane. |
| SIGMA | Sidewash angle in degrees. This angle is measured with respect to the X-axis in a plane parallel to the X-Y plane. |
| CP | Local field pressure coefficient $(CP = (P_{static} - P_{inf})/q_{inf})$. |
| MLOC | Local Mach number. |
| P/PTØT | Local static-to-total pressure ratio for isentropic flow. |
| P/PINF | Local to-freestream static pressure ratio for isentropic flow. |

## TABLE A-1. SAMPLE OUTPUT

```
********** INPUT DECK **********

SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (1/10 SCALE).
1          0         1                   0.10      0.0        0.0        0.0        11

2               0.500     2.550

1               5.000

0               0.0       0.0       0.0        0.0        1.000

11              9676.80   107.2280  191.0400   -5.4500    129.0000

**********   1 **********
     0.0       0.0       4.5762   352.3999              FUSELAGE (FUSIFORM PANEL)
     0.0       0.0      -9.7868   352.3999              FUSELAGE (FUSIFORM PANEL)
  3.0000   48.0000     0.0       999.0000              NVOR,RNCV,SPC,PDL
   90.00    7.1815     35.00      7.1815    -23.74     7.1815    -90.00     7.1815
     0.0       0.0   1         29          2          0          1
     0.0    3.4052    6.8104    10.2157    13.6209    17.0261    20.4313    23.8365
 27.2418   30.6470   34.0522    37.4574    40.8627    44.2679    47.6731    54.4825
 60.1989   63.5641   66.9693    70.3746    75.6044    77.1850    80.5902    83.9955
 87.4007   90.8059   94.2111    97.6163   100.0000
 -1.0783   -0.8726   -0.6739    -0.5750    -0.4597    -0.4512    -0.4881    -0.5931
 -0.7616   -0.9243   -1.0423    -1.1501    -1.2789    -1.4015    -1.5233    -1.7477
 -1.9552   -2.0687   -2.1283    -2.1737    -2.1793    -2.1737    -2.1254    -2.0233
 -1.8927   -1.7281   -1.5125    -1.2571    -1.0499
     0.0   16.0000   30.2500    45.0000    59.2900    72.2500    85.0000   100.0000
100.0000  100.0000  100.0000   100.0000   100.0000   100.0000   100.0000   100.0000
100.0000  100.0000  100.0000   100.0000   100.0000   100.0000    85.0000    72.2500
 59.2900   45.0000   30.2500    16.0000     0.0

**********   2 **********
 94.4100    6.5740   -5.4960   144.8940              WING PANEL NO. 1
146.2500   22.3940   -5.4470    92.5570              WING PANEL NO. 1
  4.0000   10.0000    1.0000     0.0                 NVOR,RNCV,SPC,PDL
     0.0       0.0   0         13          2          0          0
     0.0    1.0000    5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
 60.0000   70.0000   80.0000    90.0000   100.0000
     0.0   -0.0129   -0.1367    -0.4893    -1.2589    -1.9373    -2.4770    -2.8862
 -3.1954   -3.4439   -3.6668    -3.9008    -4.1644
     0.0    0.0529    0.2700     0.3078     0.1145    -0.2430    -0.6525    -1.1609
 -1.6545   -2.1469   -2.6232    -3.0692    -3.4807

**********   3 **********
146.2500   22.3940   -5.4470    92.5970              WING PANEL NO. 2
176.8800   31.7410   -6.9000    65.0010              WING PANEL NO. 2
  3.0000   10.0000    1.0000     0.0                 NVOR,RNCV,SPC,PDL
     0.0       0.0   0         13          2          0          0
     0.0    1.0000    5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
 60.0000   70.0000   80.0000    90.0000   100.0000
     0.0    0.0529    0.2700     0.3078     0.1145    -0.2430    -0.6625    -1.1609
 -1.6545   -2.1469   -2.6232    -3.0692    -3.4807
     0.0    0.0138    0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
 -0.3554   -0.6585   -0.9846    -1.3231    -1.6677

**********   4 **********
176.8800   31.7410   -6.9000    65.0010              WING PANEL NO. 3
190.5400   36.8040   -7.7160    52.9870              WING PANEL NO. 3
  2.0000   10.0000    1.0000     0.0                 NVOR,RNCV,SPC,PDL
     0.0       0.0   0         13          2          0          0
     0.0    1.0000    5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
 60.0000   70.0000   80.0000    90.0000   100.0000
     0.0    0.0138    0.1708     0.3497     0.4138     0.3277     0.1538    -0.0785
 -0.3554   -0.6585   -0.9846    -1.3231    -1.6677
     0.0    0.0151    0.0774     0.2623     0.3095     0.2567     0.1379    -0.0226
 -0.2227   -0.4511   -0.7002    -0.9606    -1.2362
```

TABLE A-1. - Continued

```
**********  5 **********
  190.5400   36.8040   -7.7160   52.9870              WING PANEL NO. 4
  222.5800   48.6830   -8.9740   31.1720              WING PANEL NO. 4
    4.0000   10.0000    1.0000    0.0                 NVOR,RNCV,SPC,PDL
    0.0       0.0    0         13          2          0         0
    0.0       1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
    0.0       0.0151    0.0774    0.2623    0.3095    0.2567    0.1378   -0.0226
   -0.2227   -0.4511   -0.7002   -0.9606   -1.2362
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1925    0.2310
    0.2631    0.2919    0.3112    0.3272    0.3368

**********  6 **********
  222.5800   48.6830   -8.9740   31.1720              WING PANEL NO. 5
  248.0000   64.5000  -10.0000   19.4500              WING PANEL NO. 5
    5.0000   10.0000    0.0       0.0                 NVOR,RNCV,SPC,PDL
    0.0       0.0    0         13          2          0         0
    0.0       1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
    0.0      -0.0411   -0.1800   -0.3137   -0.4371   -0.4731   -0.4628   -0.3651
   -0.2057   -0.0051    0.2674    0.5811    0.9103

**********  7 **********
  209.4000   22.3940   -3.4000   39.3000                UPPER NACELLE PYLON
  209.4000   22.3940   -5.4470   39.3000                UPPER NACELLE PYLON
    1.0000   10.0000    0.0       0.0
    0.0       0.0    0          0          2          0         0

**********  8 **********
  209.4000   22.3940    3.3840   39.3000              UPPER NACELLE
  209.4000   22.3940    3.3840   39.3000              UPPER NACELLE
    6.0000   10.0000    0.0     999.0000              NVOR,RNCV,SPC,PDL
     90.00    3.3920     30.00    3.3920    -30.00    3.3920    -90.00    3.3920
   -150.00    3.3920   -210.00    3.3920   -270.00    3.3920
    0.0       0.0    1          3          2          0         1
    0.0      12.1522  100.0000
    0.0       0.0       0.0
  100.0000  100.0000  100.0000

**********  9 **********
  209.1000   22.3940   -5.4470   39.4000                 LOWER NACELLE PYLON
  209.1000   22.3940   -7.2000   39.4000                 LOWER NACELLE PYLON
    1.0000   10.0000    0.0       0.0
    0.0       0.0    0          0          2          0         0

********** 10 **********
  209.1000   22.3940   -7.2000   39.4000              LOWER NACELLE
  209.1000   22.3940   -7.2000   39.4000              LOWER NACELLE
    6.0000   10.0000    0.0     999.0000              NVOR,RNCV,SPC,PDL
     90.00    3.2000     30.00    3.2000    -30.00    3.2000    -90.00    3.2000
   -150.00    3.2000   -210.00    3.2000   -270.00    3.2000
    0.0       0.0    1          3          2          0         1
    0.0      11.9148  100.0000
    0.0       0.0       0.0
  100.0000  100.0000  100.0000

********** 11 **********
  248.0000   64.5000  -10.0000   19.45000              FIN PANEL NO. 1
  259.5398   64.5000   -2.8000   14.1100              FIN PANEL NO. 1
    4.0000   10.0000    0.0       0.0                 NVOR,RNCV,SPC,PDL
    0.0       0.0    0          0          2          0         0

 0          0          0

********* END OF INPUT DECK **********
```

## TABLE A-1. - Continued

```
SUPERSONIC CRUISE VEHICLE (CL1607-32/-74 WING) WITH O/U NACELLES. (1/10 SCALE).


PANEL GEOMETRY

 I  XAPEX(I)  YAPEX(I)  ZAPEX(I)    PD.(I)   LESWP(I) CSTART(I)  TAPER(I)  PSPAN(I)  NVOR(I)  RNCV(I)   SPC(I)

 1    0.0       0.0       4.5762  999.0000    0.0     352.3594    1.0000   21.5263      3.      48.      0.0
 2   94.4100    5.5740   -5.4960    0.1775  73.0293  144.9940    0.6391   15.9201      4.      10.      1.00
 3  146.2500   22.3940   -5.4470   -8.1360  72.8381   92.5970    0.7020    9.4893      3.      10.      1.00
 4  176.8800   31.7410   -6.9000   -9.1556  69.4225   65.0010    0.8152    5.1283      7.      10.      1.00
 5  190.5400   36.8040   -7.7160   -6.0452  64.5531   52.9870    0.5983   11.9454      4.      10.      1.00
 6  222.5900   43.6930   -3.9740   -3.7114  58.0550   31.1720    0.6740   15.8562      5.      10.      0.0
 7  269.4000   22.3940   -3.4000  -90.0000   0.0      34.3000    1.0000    2.0470      1.      10.      0.0
 8  259.4000   22.3940    3.3340  999.0000   0.0      39.3000    1.0000   20.3520      6.      10.      0.0
 9  209.1000   22.3940   -5.4470  -90.0000   0.0      39.4000    1.0000    1.7530      1.      10.      0.0
10  209.1000   22.3940   -7.2000  999.0000   0.0      39.4000    1.0000   19.2000      6.      10.      0.0
11  248.0000   64.4000  -10.0000   90.0000  58.0380   19.4500    0.7254    7.2000      4.      10.      0.0
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     1

    0.0       0.0
    0.0614    0.0612    0.0609    0.0604    0.0598    0.0639    0.0581    0.0515    0.0443    0.0269
    0.0168    0.0052   -0.0069   -0.0157   -0.0313   -0.0445   -0.0542   -0.0339   -0.0325   -0.0340
   -0.0372   -0.0354   -0.0384   -0.0323   -0.0342   -0.0371   -0.0348   -0.0283   -0.0165   -0.0120
   -0.0022    0.0017    0.0041    0.0214    0.0316    0.0374    0.0417    0.0508    0.0601    0.0661
    0.0706    0.0762    0.0809    0.0849    0.0879    0.0901    0.0914    0.0919
   33.9357   16.8519   11.1351    8.1520    6.4117    4.9175    4.3401    3.9974    3.5496    3.2451
    2.8080    2.4013    2.3066    2.1679    2.7044   -0.0001   -0.0001    0.0007    0.0002    0.0001
   -0.0000    0.0002   -0.0000   -0.0031   -0.0061    0.0       0.0       0.0001    0.0001   -0.0000
   -0.0004   -0.0004   -2.3432   -2.2180   -2.1524   -2.2966   -2.7042   -2.9884   -3.3901   -3.6802
   -3.0517   -4.6004   -6.4996   -9.0661  -13.0301  -20.5287  -42.3057 -100.0000
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     2

    0.0       0.0
   -0.0261   -0.0723   -0.0739   -0.0546   -0.0359   -0.0247   -0.0229   -0.0250   -0.0271   -0.0278
    0.0600    0.0002   -0.0372   -0.0439   -0.0486   -0.0492   -0.0463   -0.0427   -0.0403   -0.0394
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     3

    0.0       0.0
    0.0600    0.0002   -0.0372   -0.0439   -0.0486   -0.0492   -0.0463   -0.0427   -0.0403   -0.0394
    0.0397    0.0277   -0.0048   -0.0171   -0.0255   -0.0304   -0.0332   -0.0342   -0.0346   -0.0348
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     4

    0.0       0.0
    0.0377    0.0277   -0.0048   -0.0171   -0.0255   -0.0304   -0.0332   -0.0342   -0.0346   -0.0348
    0.0129    0.0282   -0.0024   -0.0117   -0.0180   -0.0229   -0.0254   -0.0269   -0.0279   -0.0283
```

## TABLE A-1. - Continued

```
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     5

  0.0         0.0
  0.0124      0.0242    -0.0036    -0.0117    -0.0180    -0.0224    -0.0254    -0.0269    -0.0279    -0.0283
 -0.0242      0.0241     0.0113     0.0065     0.0035     0.0023     0.0018     0.0013     0.0008     0.0006

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     6

  0.0         0.0
 -0.0242      0.0241     0.0096     0.0062     0.0037     0.0031     0.0016     0.0013     0.0008     0.0006


 -0.0357     -0.0221    -0.0056     0.0076     0.0124     0.0224     0.0291     0.0322     0.0333     0.0327
INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     7

  0.0         0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     8

  0.0         0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0000      0.0000     0.0000     0.0000     0.0000    -0.0000    -0.0000    -0.0000    -0.0000    -0.0000

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL     9

  0.0         0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL    10

  0.0         0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
 -0.0000     -0.0000    -0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL    11

  0.0         0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
  0.0         0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
```

# TABLE A-1. - Continued

```
SUPERSONIC CRUISE VEHICLE (ELLIPT-1./-.4 WING) WITH TWO NACELLES. (1/10 SCALE).

MACH =  0.500

ALPHA =  5.000 DEG.
PSI =  0.0   DEG.

PITCH RATE =    0.0  DEG./SEC
ROLL RATE =    0.0  DEG./SEC
YAW RATE =    0.0  DEG./SEC


ANALYSIS (DIRECT) CASE    (INVERS = 0)


MOMENT AND ROTATION CENTER  :   XBAR =  0.19104E 03      ZBAR = -0.54500E 01  ***** VINF =  0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT


VORTEX WAKE FLOTATATION PARAMETERS :  FLOATX = 0.0       FLOATY = 0.0


CN REFERENCED TO SURF;  CL,CY,CD,CT,CS REFERENCED TO SREF;  CM REFERENCED TO SREF*CBAR;  CRM,CYM REFERENCED TO SREF*WSPAN

  I   SURF/SREF        CN(I)       CL(I)       CY(I)       CD(I)       CT(I)       CS(I)          CM(I)        CRM(I)        CYM(I)

  1  0.78395E 00     0.30279     0.20462     0.06256     0.00178     0.0         0.0          0.4591E-02  -0.8690E-04  -0.2451E-03
  2  0.1941E 00      0.16356     0.03164    -0.00010     0.00230     0.00096     0.00328      0.8474E-02   0.3571E-02  -0.2670E-03
  3  0.7703E-01      0.21512     0.01636     0.00255     0.00067     0.00096     0.00291      0.7174E-03   0.3436E-02  -0.2294E-03
  4  0.3126E-01      0.26704     0.00826     0.00133     0.00019     0.00054     0.00153     -0.9000E-03   0.2221E-02   0.6301E-04
  5  0.5194E-01      0.32202     0.01670     0.00176    -0.00004     0.00154     0.00441     -0.4465E-02   0.5578E-02   0.3906E-03
  6  0.4146E-01      0.37010     0.01776     0.00099     0.00148     0.0         0.0         -0.7380E-02   0.6671E-02  -0.2670E-03
  7  0.8313E-02     -0.04564    -0.00000    -0.00038    -0.00000     0.0         0.0          0.9647E-10  -0.1704E-05  -0.5411E-04
  8  0.8255E-01      0.03916    -0.00014    -0.00043    -0.00001     0.0         0.0          0.1909E-04  -0.8790E-05  -0.3386E-04
  9  0.7138E-02      0.01964     0.00000     0.00014     0.00000     0.0         0.0         -0.3530E-10   0.2869E-05   0.2190E-04
 10  0.7917E-01     -0.04563    -0.00006     0.00012    -0.00000     0.0         0.0         -0.4594E-04   0.3690E-05  -0.2815E-05
 11  0.1749E-01      0.23383     0.00000    -0.00292     0.00000     0.0         0.0         -0.2350E-08  -0.1631E-03  -0.1461E-02

      SREF          WSPAN          CHAR             CLTOT          CDTOT          CYTOT      CMTOT          CRMTOT         CYMTOT

  0.46768E 04   0.12400E 03   0.10223E 03         0.19938        0.01254         0.0       0.22025E-02   0.0            0.0


CD/CL**2 = 0.3285     E = 0.5635
```

TABLE A-1. - Continued

```
SUPERSONIC CRUISE VEHICLE (CL1467-327-24 WING) WITH O/W NACELLES. (1/10 SCALE).

MACH =  0.500    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

 S  C  X/C        X        Y        Z     CHORD   SLOPE  ITS    DCP      CNC    CN     CL      CMT        GAMMA       CTC      CDC


                              PANEL NO.   1              FUSELAGE (FUSIFORM PANEL)

 1  1 0.0003    0.044    0.127  -2.400 352.400  0.6674  1   -4.000   5.471  0.018 -27.50  -0.3922  0.1391E 03  0.0      0.64334
 1  2 0.0024    0.846    0.321  -1.909 352.400  0.3584  1    0.359                                 0.1741E 02
 1  3 0.0067    2.353    0.532  -1.533 352.400  0.2547  1    0.458                                 0.7369E 01
 1  4 0.0131    4.603    0.741  -1.132 352.400  0.2017  1    0.196                                 0.4561E 01
 1  5 0.0215    7.587    0.945  -0.790 352.400  0.1690  1    0.076                                 0.3392E 01
 1  6 0.0320   11.293    1.143  -0.409 352.400  0.1455  1    0.052                                 0.2787E 01
 1  7 0.0446   15.706    1.327  -0.057 352.400  0.1300  1    0.032                                 0.2442E 01
 1  8 0.0590   20.905    1.517   0.298 352.400  0.1161  1    0.026                                 0.2213E 01
 1  9 0.0754   26.570    1.701   0.667 352.400  0.1075  1    0.019                                 0.2049E 01
 1 10 0.0936   32.976    1.851   1.027 352.400  0.0824  1    0.009                                 0.1934E 01
 1 11 0.1135   39.995    2.079   1.376 352.400  0.0656  1    0.002                                 0.1847E 01
 1 12 0.1351   47.598    2.256   1.724 352.400  0.0480  1   -0.002                                 0.1782E 01
 1 13 0.1592   55.751    2.420   2.043 352.400  0.0355  1   -0.006                                 0.1732E 01
 1 14 0.1829   64.420    2.576   2.343 352.400  0.0251  1   -0.011                                 0.1690E 01
 1 15 0.2088   73.567    2.756   2.695 352.400  0.0121  1   -0.022                                 0.1654E 01
 1 16 0.2360   83.154    2.933   3.029 352.400 -0.0439  1   -0.048                                 0.1639E 01
 1 17 0.2643   93.140    2.941   3.045 352.400 -0.0481  1   -0.028                                 0.1611E 01
 1 18 0.2936  103.461    2.941   3.045 352.400 -0.0300  1   -0.027                                 0.1614E 01
 1 19 0.3239  114.133    2.941   3.045 352.400 -0.0288  1   -0.044                                 0.1637E 01
 1 20 0.3549  125.051    2.941   3.045 352.400 -0.0302  1   -0.059                                 0.1696E 01
 1 21 0.3865  136.189    2.941   3.045 352.400 -0.0330  1   -0.057                                 0.1659E 01
 1 22 0.4186  147.497    2.942   3.045 352.400 -0.0319  1   -0.048                                 0.1652E 01
 1 23 0.4510  158.924    2.941   3.045 352.400 -0.0314  1   -0.037                                 0.1641E 01
 1 24 0.4836  170.434    2.941   3.045 352.400 -0.0287  1   -0.035                                 0.1631E 01
 1 25 0.5164  181.965    2.941   3.045 352.400 -0.0304  1   -0.042                                 0.1625E 01
 1 26 0.5490  193.470    2.941   3.045 352.400 -0.0324  1   -0.045                                 0.1612E 01
 1 27 0.5814  204.902    2.941   3.045 352.400 -0.0309  1   -0.054                                 0.1612E 01
 1 28 0.6135  216.210    2.941   3.045 352.400 -0.0251  1   -0.036                                 0.1587E 01
 1 29 0.6451  227.348    2.942   3.045 352.400 -0.0146  1   -0.025                                 0.1564E 01
 1 30 0.6761  238.266    2.941   3.045 352.400 -0.0107  1   -0.020                                 0.1548E 01
 1 31 0.7064  248.918    2.941   3.045 352.400 -0.0026  1   -0.009                                 0.1526E 01
 1 32 0.7357  259.259    2.941   3.045 352.400  0.0019  1   -0.011                                 0.1513E 01
 1 33 0.7640  269.245    2.950   3.063 352.400 -0.0343  1   -0.027                                 0.1507E 01
 1 34 0.7912  278.832    2.808   2.790 352.400 -0.0211  1    0.007                                 0.1460E 01
 1 35 0.8172  287.979    2.644   2.474 352.400 -0.0108  1    0.016                                 0.1450E 01
 1 36 0.8418  296.648    2.489   2.176 352.400 -0.0084  1    0.018                                 0.1448E 01
 1 37 0.8649  304.801    2.333   1.875 352.400 -0.0119  1    0.018                                 0.1447E 01
 1 38 0.8865  312.404    2.163   1.551 352.400 -0.0089  1    0.025                                 0.1440E 01
 1 39 0.9064  319.423    1.988   1.214 352.400 -0.0079  1    0.028                                 0.1439E 01
 1 40 0.9246  325.829    1.807   0.865 352.400 -0.0079  1    0.033                                 0.1440E 01
 1 41 0.9410  331.594    1.630   0.525 352.400  0.0075  1    0.039                                 0.1438E 01
 1 42 0.9554  336.694    1.496   0.269 352.400 -0.0156  1    0.021                                 0.1453E 01
 1 43 0.9680  341.106    1.327  -0.056 352.400 -0.0457  1    0.021                                 0.1451E 01
 1 44 0.9785  344.813    1.126  -0.442 352.400 -0.0887  1    0.039                                 0.1442E 01
 1 45 0.9869  347.797    0.901  -0.875 352.400 -0.1576  1    0.090                                 0.1417E 01
 1 46 0.9933  350.046    0.656  -1.345 352.400 -0.2912  1    0.226                                 0.1361E 01
 1 47 0.9976  351.551    0.399  -1.840 352.400 -0.6851  1    0.394                                 0.9836E 00
 1 48 0.9997  352.305    0.133  -2.351 352.400 -1.7262  1    0.715                                -0.1169E 00
```

## TABLE A-1. - Continued

```
SUPERSONIC CRUISE VEHICLE (CL1807-32/-74 WING) WITH UAI NACELLES. (1/10 SCALE).

MACH =  0.500    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  L  X/C        X        Y        Z      CHORD    SLOPE  ITS      CCP      CMC     CN      DL      CMT        GAMMA      CTC      CDC


  2  1 0.0003    0.294    0.227   -2.583  352.400   0.6087  1     -4.000    0.018  0.020  -84.37  -0.0044  0.1369E 03  0.0     0.16316
  2  2 0.0024    0.848    0.679   -2.538  352.400   0.3053  1      0.964                                   0.1724E 02
  2  3 0.0067    2.353    1.127   -2.494  352.400   0.2032  1      0.427                                   0.7311E 01
  2  4 0.0131    4.605    1.569   -2.451  352.400   0.1514  1      0.148                                   0.4531E 01
  2  5 0.0215    7.587    2.001   -2.408  352.400   0.1197  1      0.061                                   0.3369E 01
  2  6 0.0320   11.293    2.421   -2.367  352.400   0.0938  1      0.038                                   0.2770E 01
  2  7 0.0446   15.706    2.809   -2.328  352.400   0.0824  1      0.022                                   0.2427E 01
  2  8 0.0590   20.805    3.201   -2.290  352.400   0.0743  1      0.019                                   0.2199E 01
  2  9 0.0754   26.570    3.602   -2.250  352.400   0.0674  1      0.016                                   0.2035E 01
  2 10 0.0936   32.976    4.004   -2.210  352.400   0.0603  1      0.012                                   0.1917E 01
  2 11 0.1135   39.995    4.400   -2.171  352.400   0.0515  1      0.008                                   0.1932E 01
  2 12 0.1351   47.596    4.777   -2.134  352.400   0.0432  1      0.005                                   0.1768E 01
  2 13 0.1582   55.751    5.124   -2.100  352.400   0.0356  1      0.002                                   0.1719E 01
  2 14 0.1828   64.420    5.454   -2.067  352.400   0.0369  1      0.003                                   0.1674E 01
  2 15 0.2089   73.567    5.836   -2.036  352.400   0.0261  1     -0.003                                   0.1637E 01
  2 16 0.2360   83.154    6.211   -1.992  352.400  -0.0049  1     -0.022                                   0.1624E 01
  2 17 0.2643   93.140    6.228   -1.991  352.400  -0.0053  1     -0.025                                   0.1608E 01
  2 18 0.2936  103.481    6.228   -1.991  352.400  -0.0033  1     -0.064                                   0.1638E 01
  2 19 0.3239  114.133    6.229   -1.991  352.400  -0.0032  1     -0.084                                   0.1650E 01
  2 20 0.3549  125.051    6.229   -1.991  352.400  -0.0033  1     -0.097                                   0.1677E 01
  2 21 0.3865  136.189    6.228   -1.991  352.400  -0.0037  1     -0.089                                   0.1678E 01
  2 22 0.4186  147.497    6.229   -1.991  352.400  -0.0035  1     -0.049                                   0.1655E 01
  2 23 0.4510  158.924    6.228   -1.991  352.400  -0.0035  1     -0.013                                   0.1631E 01
  2 24 0.4836  170.434    6.228   -1.991  352.400  -0.0032  1     -0.016                                   0.1625E 01
  2 25 0.5164  181.965    6.229   -1.991  352.400  -0.0034  1     -0.033                                   0.1624E 01
  2 26 0.5490  193.470    6.228   -1.991  352.400  -0.0036  1     -0.060                                   0.1607E 01
  2 27 0.5814  204.90     6.228   -1.991  352.400  -0.0034  1     -0.083                                   0.1636E 01
  2 28 0.6135  216.21     6.229   -1.991  352.400  -0.0028  1     -0.028                                   0.1582E 01
  2 29 0.6451  227.348    6.229   -1.991  352.400  -0.0016  1     -0.024                                   0.1567E 01
  2 30 0.6761  238.266    6.228   -1.991  352.400  -0.0012  1     -0.022                                   0.1559E 01
  2 31 0.7066  248.918    6.228   -1.991  352.400  -0.0002  1     -0.004                                   0.1529E 01
  2 32 0.7357  259.259    6.228   -1.991  352.400   0.0002  1     -0.009                                   0.1513E 01
  2 33 0.7640  269.245    6.248   -1.984  352.400  -0.0407  1     -0.028                                   0.1512E 01
  2 34 0.7912  278.832    5.947   -2.019  352.400  -0.0373  1     -0.001                                   0.1472E 01
  2 35 0.8172  287.979    5.599   -2.053  352.400  -0.0351  1      0.005                                   0.1463E 01
  2 36 0.8418  296.648    5.270   -2.086  352.400  -0.0371  1      0.006                                   0.1461E 01
  2 37 0.8649  304.801    4.939   -2.119  352.400  -0.0434  1      0.005                                   0.1460E 01
  2 38 0.8865  312.404    4.581   -2.154  352.400  -0.0481  1      0.008                                   0.1457E 01
  2 39 0.9066  319.473    4.210   -2.190  352.400  -0.0543  1      0.010                                   0.1457E 01
  2 40 0.9246  325.829    3.826   -2.228  352.400  -0.0584  1      0.014                                   0.1457E 01
  2 41 0.9410  331.594    3.451   -2.265  352.400  -0.0473  1      0.019                                   0.1455E 01
  2 42 0.9554  336.694    3.168   -2.293  352.400  -0.0742  1     -0.002                                   0.1474E 01
  2 43 0.9680  341.106    2.810   -2.328  352.400  -0.1075  1     -0.008                                   0.1480E 01
  2 44 0.9785  344.813    2.385   -2.370  352.400  -0.1527  1     -0.001                                   0.1485E 01
  2 45 0.9869  347.797    1.907   -2.417  352.400  -0.2228  1      0.071                                   0.1492E 01
  2 46 0.9933  350.046    1.309   -2.468  352.400  -0.3557  1      0.063                                   0.1503E 01
  2 47 0.9976  351.551    0.844   -2.522  352.400  -0.7438  1      0.066                                   0.1600E 01
  2 48 0.9997  352.305    0.281   -2.576  352.400  -1.7670  1      0.043                                   0.1930E 01

  3  1 0.0003    0.094    0.120   -2.789  352.400   0.5277  1     -4.000   -0.668 -0.029 -144.87   0.0037  0.1363E 03  0.0     0.09061
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# TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1-03-32/-3- WING) WITH OUT NACELLES. (1/10 SCALE).

MACH =  0.900    ALPHA =  4.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

 S  C  X/C      X        Y        Z      CHORD    SLOPE  ITS     CCP       CNC      CN      DL      CMT        GAMMA       CTC      CDC


 3  2 0.0024    0.846    0.354   -3.156 352.400  0.2364  1     -0.531                                          0.1696E 02
 3  3 0.0067    2.353    0.545   -3.617 352.400  0.1386  1      0.447                                          0.7751E 01
 3  4 0.0131    4.601    0.829   -3.976 352.400  0.0892  1      0.152                                          0.4496E 01
 3  5 0.0215    7.563    1.054   -4.273 352.400  0.0552  1      0.071                                          0.3343E 01
 3  6 0.0320   11.249    1.279   -4.563 352.400  0.0363  1      0.046                                          0.2750E 01
 3  7 0.0446   15.706    1.493   -4.877 352.400  0.0254  1      0.033                                          0.2411E 01
 3  8 0.0596   20.864    1.659   -5.193 352.400  0.0234  1      0.030                                          0.2182E 01
 3  9 0.0754   26.570    1.901   -5.518 352.400  0.0234  1      0.026                                          0.2019E 01
 3 10 0.0936   32.976    2.113   -5.862 352.400  0.0229  1      0.028                                          0.1898E 01
 3 11 0.1135   39.998    2.322   -6.182 352.400  0.0236  1      0.021                                          0.1815E 01
 3 12 0.1351   47.590    2.521   -6.467 352.400  0.0367  1      0.019                                          0.1751E 01
 3 13 0.1582   55.751    2.704   -6.744 352.400  0.0356  1      0.015                                          0.1704E 01
 3 14 0.1828   64.420    2.878   -7.015 352.400  0.0501  1      0.018                                          0.1656E 01
 3 15 0.2088   73.567    3.080   -7.275 352.400  0.0636  1      0.012                                          0.1616E 01
 3 16 0.2360   83.154    3.276   -7.627 352.400  0.0417  1     -0.006                                          0.1605E 01
 3 17 0.2643   93.144    3.287   -7.641 352.400  0.0454  1      0.071                                          0.1585E 01
 3 18 0.2936  103.461    3.287   -7.641 352.400  0.0283  1      0.047                                          0.1582E 01
 3 19 0.3239  114.133    3.287   -7.642 352.400  0.0272  1      0.073                                          0.1577E 01
 3 20 0.3549  125.051    3.287   -7.642 352.400  0.0285  1      0.072                                          0.1588E 01
 3 21 0.3865  136.184    3.287   -7.641 352.400  0.0312  1      0.076                                          0.1582E 01
 3 22 0.4186  147.497    3.287   -7.642 352.400  0.0301  1      0.090                                          0.1603E 01
 2 23 0.4510  158.926    3.297   -7.641 352.400  0.0298  1      0.078                                          0.1636E 01
 3 24 0.4836  170.434    3.267   -7.641 352.400  0.0271  1      0.060                                          0.1595E 01
 3 25 0.5164  181.965    3.287   -7.641 352.400  0.0287  1      0.065                                          0.1575E 01
 3 26 0.5490  193.470    3.287   -7.641 352.400  0.0311  1      0.060                                          0.1556E 01
 3 27 0.5814  204.902    3.287   -7.641 352.400  0.0292  1      0.066                                          0.1543E 01
 3 28 0.6135  216.210    3.287   -7.641 352.400  0.0237  1      0.036                                          0.1554E 01
 3 29 0.6451  227.348    3.287   -7.642 352.400  0.0138  1      0.038                                          0.1539E 01
 3 30 0.6761  238.264    3.287   -7.641 352.400  0.0101  1      0.033                                          0.1517E 01
 3 31 0.7064  248.916    3.287   -7.641 352.400  0.0018  1      0.013                                          0.1520E 01
 3 32 0.7357  259.254    3.287   -7.641 352.400 -0.0014  1     -0.002                                          0.1511E 01
 3 33 0.7640  269.245    3.287   -7.657 352.400 -0.0476  1     -0.028                                          0.1517E 01
 3 34 0.7912  278.832    3.138   -7.414 352.400 -0.0558  1     -0.006                                          0.1486E 01
 3 35 0.8172  287.979    2.955   -7.122 352.400 -0.0632  1     -0.001                                          0.1478E 01
 3 36 0.8418  296.648    2.781   -6.857 352.400 -0.0708  1      0.001                                          0.1475E 01
 3 37 0.8649  304.801    2.607   -6.594 352.400 -0.0811  1      0.000                                          0.1475E 01
 3 38 0.8865  312.404    2.418   -6.310 352.400 -0.0934  1      0.001                                          0.1475E 01
 3 39 0.9064  319.423    2.222   -6.010 352.400 -0.1082  1      0.003                                          0.1478E 01
 3 40 0.9246  325.829    2.019   -5.699 352.400 -0.1181  1      0.009                                          0.1478E 01
 3 41 0.9410  331.594    1.821   -5.394 352.400 -0.1117  1      0.014                                          0.14[illegible]E 01
 3 42 0.9554  336.694    1.672   -5.167 352.400 -0.1473  1     -0.011                                          0.1498E 01
 3 43 0.9680  341.106    1.483   -4.877 352.400 -0.1787  1     -0.021                                          0.1514E 01
 3 44 0.9785  344.813    1.259   -4.534 352.400 -0.2250  1     -0.029                                          0.1537E 01
 3 45 0.9869  347.797    1.067   -4.148 352.400 -0.2960  1     -0.041                                          0.1581E 01
 3 46 0.9933  350.046    0.733   -3.729 352.400 -0.4258  1     -0.063                                          0.1683E 01
 3 47 0.9976  351.551    0.445   -3.288 352.400 -0.7999  1      0.039                                          0.1872E 01
 3 48 0.9997  352.305    0.148   -2.832 352.400 -1.7835  1      0.817                                          0.1344E 01

                                   PANEL NO.   2                WING PANEL NO. 1

 4  1 0.0062  101.742    8.551   -5.490 130.357 -0.0153  0      0.693    19.142  0.138    0.18   -0.0192   0.3470E 00  0.34960  2.07699
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1967-32/-34 WING) WITH CANARD..., (C/12) ...

MACH =  0.500    ALPHA =  5.000 DG    PSI =  0.0  DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

 S  C  X/C       X         Y         Z      CHORD    SLOPE  ITS      DCP        CVC      CN       CL       CMT          GAMMA       CTC       CDC

 4  2 0.0545 109.630    8.551    -5.440 139.357 -0.0062   0      0.704                                            0.1023E 00
 4  3 0.1464 121.147    8.551    -5.440 139.357 -0.0417   0      0.349                                            0.1276E 00
 4  4 0.2730 138.662    8.551    -5.440 139.357 -0.0253   0      0.200                                            0.1005E 00
 4  5 0.4218 159.268    8.551    -5.440 139.357 -0.0275   0     -0.019                                           -0.9461E-02
 4  6 0.5782 180.346    8.551    -5.440 139.357 -0.0279   0      0.046                                            0.2429E-01
 4  7 0.7270 201.474    8.551    -5.440 139.357 -0.0257   0      0.219                                            0.1079E 00
 4  8 0.8536 219.087    8.551    -5.440 139.357 -0.0272   0     -0.011                                           -0.5766E-02
 4  9 0.9455 231.737    8.551    -5.440 139.357 -0.0264   0      0.098                                            0.4995E-01
 4 10 0.9938 238.345    8.551    -5.440 139.357 -0.0269   0      0.467                                            0.2342E 00

 5  1 0.0062 114.621   12.506    -5.478 125.283  0.0062   0      0.758      19.154   0.183     0.18   -0.0152    0.3797E 00  0.56511  1.72370
 5  2 0.0545 120.677   12.506    -5.478 125.283 -0.0441   0      0.329                                            0.1696E 00
 5  3 0.1464 132.147   12.506    -5.478 125.283 -0.0582   0      0.290                                            0.1202E 00
 5  4 0.2730 148.002   12.506    -5.478 125.283 -0.0505   0      0.140                                            0.7039E-01
 5  5 0.4218 166.672   12.506    -5.478 125.283 -0.0407   0      0.077                                            0.3975E-01
 5  6 0.5782 186.266   12.506    -5.478 125.283 -0.0334   0      0.104                                            0.5196E-01
 5  7 0.7270 204.924   12.506    -5.478 125.283 -0.0318   0      0.158                                            0.7469E-01
 5  8 0.8536 220.785   12.506    -5.478 125.283 -0.0317   0      0.068                                            0.3266E-01
 5  9 0.9455 232.365   12.506    -5.478 125.283 -0.0326   0      0.067                                            0.3392E-01
 5 10 0.9938 238.361   12.506    -5.478 125.283 -0.0322   0      0.092                                            0.4661E-01

 6  1 0.0062 127.506   16.461    -5.465 112.208  0.0277   0      0.887      19.510   0.176     0.18   -0.0177    0.4453E 00  0.69383  1.47152
 6  2 0.0545 132.925   16.461    -5.465 112.208 -0.0270   0      0.378                                            0.1949E 00
 6  3 0.1464 143.242   16.461    -5.465 112.208 -0.0473   0      0.268                                            0.1228E 00
 6  4 0.2730 157.443   16.461    -5.465 112.208 -0.0476   0      0.152                                            0.7694E-01
 6  5 0.4218 174.137   16.461    -5.465 112.208 -0.0438   0      0.121                                            0.6354E-01
 6  6 0.5782 191.690   16.461    -5.465 112.208 -0.0400   0      0.125                                            0.6261E-01
 6  7 0.7270 208.384   16.461    -5.465 112.208 -0.0375   0      0.181                                            0.9366E-01
 6  8 0.8536 222.589   16.461    -5.465 112.209 -0.0361   0      0.076                                            0.3951E-01
 6  9 0.9455 232.902   16.461    -5.465 112.209 -0.0353   0      0.061                                            0.3047E-01
 6 10 0.9938 238.327   16.461    -5.465 112.208 -0.0351   0      0.031                                            0.1548E-01

 7  1 0.0062 140.306   20.416    -5.453  99.134  0.0443   0      0.676      19.736   0.200     0.18   -0.0221    0.4900E 00  0.75376  1.33710
 7  2 0.0545 145.172   20.416    -5.453  99.134 -0.0064   0      0.467                                            0.2345E 00
 7  3 0.1464 154.287   20.416    -5.453  99.134 -0.0374   0      0.266                                            0.1325E 00
 7  4 0.2730 166.834   20.416    -5.453  99.134 -0.0451   0      0.186                                            0.9339E-01
 7  5 0.4218 181.582   20.416    -5.453  99.134 -0.0470   0      0.155                                            0.7796E-01
 7  6 0.5782 197.086   20.416    -5.453  99.134 -0.0461   0      0.142                                            0.7119E-01
 7  7 0.7270 211.834   20.416    -5.453  99.134 -0.0474   0      0.240                                            0.1203E 00
 7  8 0.8536 224.368   20.416    -5.453  99.134 -0.0460   0      0.081                                            0.4047E-01
 7  9 0.9455 233.501   20.416    -5.453  99.134 -0.0336   0      0.058                                            0.2753E-01
 7 10 0.9938 238.292   20.416    -5.453  99.134 -0.0380   0      0.016                                            0.8018E-02

                                   PANEL NO.   3                WING PANEL NO. 2

 8  1 0.0062 151.897   23.952    -5.689  87.998  0.0566   0      1.065      17.259   0.196    -8.84   -0.0131    0.5346E 00  0.79570  0.85062
 8  2 0.0545 156.151   23.952    -5.689  87.998  0.0068   0      0.427                                            0.2168E 00
 8  3 0.1464 164.242   23.952    -5.689  87.998 -0.0327   0      0.280                                            0.1451E 00
 8  4 0.2730 175.376   23.952    -5.689  87.998 -0.0393   0      0.217                                            0.1090E 00
 8  5 0.4219 188.471   23.952    -5.689  87.998 -0.0447   0      0.187                                            0.9120E-01
 8  6 0.5782 202.237   23.952    -5.689  87.998 -0.0460   0      0.140                                            0.7012E-01
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-337-26 WING) WITH D/H NACELLES (1/30 SCALE).

MACH =  0.500     ALPHA =  5.700 DG     PSI =  0.0   DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

 S  C  X/C        X        Y         Z       CHORD    SLOPE   ITS      DCP       CNC      CN        CL       CMT        GAMMA       CTC      CDC


 8  7 0.7270 215.324   23.952   -5.609   57.998 -0.0441   0       0.067                                          0.4618E-01
 8  8 0.8536 226.448   23.952   -5.609   57.998 -0.0417   0       0.066                                          0.4730E-01
 8  9 0.9455 234.557   23.952   -5.609   57.998 -0.0393   0       0.064                                          0.2956E-01
 8 10 0.9938 238.911   23.952   -5.609   57.998 -0.0356   0       0.026                                          0.1302E-01

 9  1 0.0062 162.050   27.067   -6.173   78.799  0.0499   0       1.166    17.460   0.314    -9.04   -0.0152    0.5951E 00  0.87137  0.69443
 9  2 0.0545 165.856   27.067   -6.173   78.799  0.0141   0       0.454                                          0.2279E 00
 9  3 0.1464 173.105   27.067   -6.173   78.799 -0.0195   0       0.317                                          0.1590E 00
 9  4 0.2730 183.077   27.067   -6.173   78.799 -0.0306   0       0.246                                          0.1234E 00
 9  5 0.4218 194.801   27.067   -6.173   78.799 -0.0376   0       0.194                                          0.9967E-01
 9  6 0.5782 207.124   27.067   -6.173   78.799 -0.0394   0       0.140                                          0.7039E-01
 9  7 0.7270 218.851   27.067   -6.173   78.799 -0.0387   0       0.121                                          0.6077E-01
 9  8 0.8536 228.824   27.067   -6.173   78.799 -0.0374   0       0.105                                          0.5259E-01
 9  9 0.9455 236.076   27.067   -6.173   78.799 -0.0376   0       0.066                                          0.3216E-01
 9 10 0.9938 239.874   27.067   -6.173   78.799 -0.0371   0       0.022                                          0.1109E-01

10  1 0.0062 172.203   30.183   -6.658   69.600  0.0431   0       1.298    16.944   0.298    -9.04   -0.0166    0.6515E 00  0.96421  0.49674
10  2 0.0545 175.564   30.183   -6.658   69.600  0.0231   0       0.483                                          0.2475E 00
10  3 0.1464 181.962   30.183   -6.658   69.600 -0.0093   0       0.350                                          0.1800E 00
10  4 0.2730 190.778   30.183   -6.658   69.600 -0.0216   0       0.270                                          0.1356E 00
10  5 0.4218 201.131   30.183   -6.658   69.600 -0.0294   0       0.204                                          0.1044E 00
10  6 0.5782 212.015   30.183   -6.658   69.600 -0.0335   0       0.159                                          0.7998E-01
10  7 0.7270 222.374   30.183   -6.658   69.600 -0.0353   0       0.140                                          0.7015E-01
10  8 0.8536 231.182   30.183   -6.658   69.600 -0.0356   0       0.111                                          0.5567E-01
10  9 0.9455 237.582   30.183   -6.658   69.600 -0.0358   0       0.069                                          0.3469E-01
10 10 0.9938 240.942   30.183   -6.658   69.600 -0.0359   0       0.023                                          0.1173E-01

                                      PANEL NO.    4                    WING PANEL NO. 3

11  1 0.0062 180.677   33.007   -7.104   61.997  0.0330   0       1.517    16.068   0.289    -9.16   -0.0171    0.7612E 00  0.99188  0.39314
11  2 0.0545 183.674   33.007   -7.104   61.997  0.0278   0       0.563                                          0.2774E 00
11  3 0.1464 189.374   33.007   -7.104   61.997 -0.0042   0       0.382                                          0.1918E 00
11  4 0.2730 197.221   33.007   -7.104   61.997 -0.0158   0       0.281                                          0.1408E 00
11  5 0.4218 206.444   33.007   -7.104   61.997 -0.0238   0       0.218                                          0.1096E 00
11  6 0.5782 216.143   33.007   -7.104   61.997 -0.0285   0       0.174                                          0.8997E-01
11  7 0.7270 225.367   33.007   -7.104   61.997 -0.0312   0       0.153                                          0.7673E-01
11  8 0.8536 233.213   33.007   -7.104   61.997 -0.0324   0       0.118                                          0.5902E-01
11  9 0.9455 238.914   33.007   -7.104   61.997 -0.0329   0       0.074                                          0.3690E-01
11 10 0.9938 241.911   33.007   -7.104   61.997 -0.0332   0       0.025                                          0.1252E-01

12  1 0.0062 187.476   35.538   -7.512   55.990  0.0196   0       1.656    15.439   0.276    -9.14   -0.0184    0.8300E 00  1.04267  0.31752
12  2 0.0545 190.176   35.538   -7.512   55.990  0.0280   0       0.473                                          0.2978E 00
12  3 0.1464 195.325   35.538   -7.512   55.990 -0.0030   0       0.461                                          0.2013E 00
12  4 0.2730 202.411   35.538   -7.512   55.990 -0.0131   0       0.287                                          0.1460E 00
12  5 0.4218 210.741   35.538   -7.512   55.990 -0.0194   0       0.232                                          0.1166E 00
12  6 0.5782 219.500   35.538   -7.512   55.990 -0.0248   0       0.196                                          0.9861E-01
12  7 0.7270 227.830   35.538   -7.512   55.990 -0.0272   0       0.166                                          0.8228E-01
12  8 0.8536 234.916   35.538   -7.512   55.990 -0.0287   0       0.126                                          0.6212E-01
12  9 0.9455 240.064   35.538   -7.512   55.990 -0.0296   0       0.079                                          0.3914E-01
12 10 0.9938 242.771   35.538   -7.512   55.990 -0.0299   0       0.027                                          0.1367E-01

                                      PANEL NO.    5                    WING PANEL NO. 4

13  1 0.0062 194.854   38.289   -7.873   50.260  0.0083   0       1.809    14.727   0.293    -8.05   -0.0186    0.9077E 00  1.12199  0.19800
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### TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-92/-24 WING) WITH DUAL NACELLES. (1/15 SCALE).

MACH =  0.500    ALPHA =  5.000 DG     PSI =  0.0    DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

  S  C  X/C        X        Y         Z      CHORD    SLOPE  IT       DCP       CNC      CN       CL       CMT          GAMMA        CTC       CDC


 13  2 0.0545 197.794   39.289   -7.473   50.260   0.0252  0       0.617                                              0.30718E 00
 13  3 0.1464 201.905   39.289   -7.473   50.260  -0.0016  0       0.420                                              0.21077E 00
 13  4 0.2730 208.264   39.289   -7.473   50.260  -0.0204  0       0.308                                              0.15446E 00
 13  5 0.4218 215.744   39.289   -7.473   50.260  -0.0193  0       0.250                                              0.12536E 00
 13  6 0.5782 223.606   39.289   -7.473   50.260  -0.0197  0       0.213                                              0.10678E 00
 13  7 0.7270 231.084   39.289   -7.473   50.260  -0.0220  0       0.172                                              0.86538E-01
 13  8 0.8536 237.447   39.289   -7.473   50.260  -0.0234  0       0.126                                              0.63298E-01
 13  9 0.9455 242.066   39.289   -7.473   50.260  -0.0244  0       0.078                                              0.39206E-01
 13 10 0.9938 244.494   39.289   -7.473   50.260  -0.0247  0       0.025                                              0.12473E-01

 14  1 0.0062 202.931   41.259   -8.168   44.926  -0.0216  0       1.477     13.477   0.312    -0.08    -0.0175      0.44920E 00  1.19411   0.05440
 14  2 0.0545 204.947   41.259   -8.168   44.926   0.0191  0       0.662                                              0.33118E 00
 14  3 0.1464 209.117   41.259   -8.168   44.926   0.0016  0       0.446                                              0.22079E 00
 14  4 0.2730 214.787   41.259   -8.168   44.926  -0.0049  0       0.326                                              0.16472E 00
 14  5 0.4218 221.457   41.259   -8.168   44.926  -0.0094  0       0.272                                              0.13772E 00
 14  6 0.5782 228.463   41.259   -8.168   44.926  -0.0130  0       0.227                                              0.11461E 00
 14  7 0.7270 235.129   41.259   -8.168   44.926  -0.0152  0       0.179                                              0.87773E-01
 14  8 0.8536 240.799   41.259   -8.168   44.926  -0.0162  0       0.121                                              0.60978E-01
 14  9 0.9455 244.919   41.259   -8.168   44.926  -0.0177  0       0.070                                              0.35538E-01
 14 10 0.9938 247.085   41.259   -8.168   44.926  -0.0175  0       0.023                                              0.11597E-01

 15  1 0.0062 210.803   44.228   -8.502   39.353  -0.0163  0       2.172     13.169   0.299    -0.09    -0.0152      0.13902E 01  1.27488  -0.09027
 15  2 0.0545 212.704   44.228   -8.502   39.353   0.0171  0       0.719                                              0.34610E 00
 15  3 0.1464 216.326   44.228   -8.502   39.353   0.0043  0       0.472                                              0.23646E 00
 15  4 0.2730 221.305   44.228   -8.502   39.353  -0.0060  0       0.367                                              0.18394E 00
 15  5 0.4218 227.163   44.228   -8.502   39.353  -0.0084  0       0.307                                              0.15194E 00
 15  6 0.5782 233.314   44.228   -8.502   39.353  -0.0098  0       0.236                                              0.11778E 00
 15  7 0.7270 239.174   44.228   -8.502   39.353  -0.0084  0       0.171                                              0.85878E-01
 15  8 0.8536 244.154   44.228   -8.502   39.353  -0.0093  0       0.114                                              0.57568E-01
 15  9 0.9455 247.773   44.228   -8.502   39.353  -0.0105  0       0.068                                              0.32098E-01
 15 10 0.9938 249.675   44.228   -8.502   39.353  -0.0107  0       0.022                                              0.11038E-01

 16  1 0.0062 218.782   47.198   -8.817   33.899  -0.0196  0       2.662     12.336   0.366    -0.05    -0.0069      0.12296E 01  1.39289  -0.27624
 16  2 0.0545 220.472   47.198   -8.817   33.899   0.0071  0       0.820                                              0.41196E 00
 16  3 0.1464 223.539   47.198   -8.817   33.899   0.0064  0       0.555                                              0.27838E 00
 16  4 0.2730 227.824   47.198   -8.817   33.899   0.0043  0       0.417                                              0.20945E 00
 16  5 0.4218 232.873   47.198   -8.817   33.899   0.0008  0       0.312                                              0.15668E 00
 16  6 0.5782 238.176   47.198   -8.817   33.899  -0.0006  0       0.237                                              0.11898E 00
 16  7 0.7270 243.218   47.198   -8.817   33.899  -0.0016  0       0.161                                              0.80594E-01
 16  8 0.8536 247.504   47.198   -8.817   33.899  -0.0023  0       0.106                                              0.53128E-01
 16  9 0.9455 250.626   47.198   -8.817   33.899  -0.0026  0       0.062                                              0.30928E-01
 16 10 0.9938 252.208   47.198   -8.817   33.899  -0.0030  0       0.020                                              0.99658E-02

                                   PANEL NO.   6                  WING PANEL NO. 5

 17  1 0.0062 225.307   50.265   -9.077   30.000  -0.0254  0       3.125     11.221   0.390     0.71     0.0005      0.13698E 01  0.0       1.05437
 17  2 0.0545 226.757   50.265   -9.077   30.000   0.0016  0       0.976                                              0.48878E 00
 17  3 0.1464 229.515   50.265   -9.077   30.000   0.0070  0       0.572                                              0.28718E 00
 17  4 0.2730 233.312   50.265   -9.077   30.000   0.0056  0       0.401                                              0.20128E 00
 17  5 0.4218 237.775   50.265   -9.077   30.000   0.0046  0       0.290                                              0.14558E 00
 17  6 0.5782 242.468   50.265   -9.077   30.000   0.0049  0       0.206                                              0.10346E 00
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-322-24 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  0.500    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

 S  C  X/C       X        Y         Z       CHORD    SLOPE  ITS      DCP      CNC     CN      DL       CMT        GAMMA       CTC      CDC

17  7 0.7270 246.932   50.265   -9.077   30.000   0.0044  0       0.144                                        0.7243E-01
17  8 0.8536 250.728   50.265   -9.077   30.000   0.0043  0       0.096                                        0.4693E-01
17  9 0.9455 253.487   50.265   -9.077   30.000   0.0040  0       0.053                                        0.2669E-01
17 10 0.9938 254.937   50.265   -9.077   30.000   0.0039  0       0.017                                        0.9696E-02

18  1 0.0062 230.376   53.428   -9.282   27.655  -0.0277  0       3.196    10.361  0.375   -3.71    0.0063   0.1604E 01  0.0      0.98102
18  2 0.0545 231.713   53.428   -9.282   27.655  -0.0040  0       1.006                                        0.5052E 00
18  3 0.1464 234.253   53.428   -9.282   27.655   0.0042  0       0.571                                        0.2914E 00
18  4 0.2730 237.756   53.428   -9.282   27.655   0.0048  0       0.397                                        0.1991E 00
18  5 0.4210 241.870   53.428   -9.282   27.655   0.0064  0       0.276                                        0.1388E 00
18  6 0.5782 246.197   53.428   -9.282   27.655   0.0083  0       0.192                                        0.9641E-01
18  7 0.7270 250.311   53.428   -9.282   27.655   0.0098  0       0.131                                        0.6559E-01
18  8 0.8536 253.811   53.428   -9.282   27.655   0.0105  0       0.085                                        0.4279E-01
18  9 0.9455 256.354   53.428   -9.282   27.655   0.0106  0       0.049                                        0.2457E-01
18 10 0.9938 257.691   53.428   -9.282   27.655   0.0106  0       0.016                                        0.8019E-02

19  1 0.0062 235.446   56.591   -9.487   25.311  -0.0360  0       3.266     9.370  0.370   -3.71    0.0074   0.1639E 01  0.0      0.90573
19  2 0.0545 236.669   56.591   -9.487   25.311  -0.0094  0       1.031                                        0.5174E 00
19  3 0.1464 238.997   56.591   -9.487   25.311   0.0014  0       0.583                                        0.2924E 00
19  4 0.2730 242.200   56.591   -9.487   25.311   0.0034  0       0.388                                        0.1946E 00
19  5 0.4210 245.966   56.591   -9.487   25.311   0.0083  0       0.260                                        0.1364E 00
19  6 0.5782 249.925   56.591   -9.487   25.311   0.0118  0       0.178                                        0.8949E-01
19  7 0.7270 253.691   56.591   -9.487   25.311   0.0153  0       0.121                                        0.6071E-01
19  8 0.8536 256.894   56.591   -9.487   25.311   0.0167  0       0.080                                        0.4027E-01
19  9 0.9455 259.221   56.591   -9.487   25.311   0.0171  0       0.046                                        0.2299E-01
19 10 0.9938 260.445   56.591   -9.487   25.311   0.0172  0       0.015                                        0.7435E-02

20  1 0.0062 240.515   59.755   -9.692   22.967  -0.0322  0       3.317     8.385  0.365   -3.71    0.0094   0.1665E 01  0.0      0.82633
20  2 0.0545 241.625   59.755   -9.692   22.967  -0.0147  0       1.045                                        0.5246E 00
20  3 0.1464 243.737   59.755   -9.692   22.967  -0.0014  0       0.579                                        0.2885E 00
20  4 0.2730 246.644   59.755   -9.692   22.967   0.0023  0       0.371                                        0.1860E 00
20  5 0.4210 250.061   59.755   -9.692   22.967   0.0101  0       0.247                                        0.1237E 00
20  6 0.5782 253.653   59.755   -9.692   22.967   0.0152  0       0.177                                        0.8891E-01
20  7 0.7270 257.070   59.755   -9.692   22.967   0.0208  0       0.117                                        0.5860E-01
20  8 0.8536 259.977   59.755   -9.692   22.967   0.0229  0       0.073                                        0.3669E-01
20  9 0.9455 262.089   59.755   -9.692   22.967   0.0236  0       0.040                                        0.1985E-01
20 10 0.9938 263.199   59.755   -9.692   22.967   0.0232  0       0.012                                        0.6227E-02

21  1 0.0062 245.585   62.910   -9.897   20.622  -0.0344  0       3.284     7.387  0.358   -3.71    0.0120   0.1648E 01  0.0      0.74211
21  2 0.0545 246.582   62.910   -9.897   20.622  -0.0201  0       1.022                                        0.5131E 00
21  3 0.1464 248.478   62.910   -9.897   20.622  -0.0047  0       0.565                                        0.2737E 00
21  4 0.2730 251.088   62.910   -9.897   20.622   0.0012  0       0.395                                        0.1983E 00
21  5 0.4210 254.136   62.910   -9.897   20.622   0.0119  0       0.269                                        0.1350E 00
21  6 0.5782 257.382   62.910   -9.897   20.622   0.0187  0       0.170                                        0.8528E-01
21  7 0.7270 260.450   62.910   -9.897   20.622   0.0263  0       0.093                                        0.4657E-01
21  8 0.8536 263.060   62.910   -9.897   20.622   0.0291  0       0.052                                        0.2618E-01
21  9 0.9455 264.956   62.910   -9.897   20.622   0.0301  0       0.026                                        0.1323E-01
21 10 0.9938 265.953   62.910   -9.897   20.622   0.0304  0       0.008                                        0.4019E-02

                                   PANEL NO.   7                UPPER NACELLE PYLON

22  1 0.0062 209.142   22.394   -4.423   39.300   0.0     0      -0.692    -1.796 -0.046  -90.00   -0.0114  -0.3473E 00  0.0     -0.00000
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (SCL1637-227-24 WING) WITH (4) NACELLES. (1/10 SCALE).

MACH =  0.900    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  C  X/C        X         Y         Z      CHORD    SLOPE  ITS     DCP       CNC      CN       DL       CMT       GAMMA       CTC       CDC


 22  2 0.0545  211.542    22.394   -4.423   39.300   0.0      0    -0.420                                         -0.2037E 00
 22  3 0.1464  215.155    22.394   -4.423   39.300   0.0      0    -0.029                                         -0.1418E-01
 22  4 0.2730  220.129    22.394   -4.423   39.300   0.0      0     0.009                                          0.2440E-02
 22  5 0.4218  225.976    22.394   -4.423   39.300   0.0      0     0.002                                          0.1001E-02
 22  6 0.5782  232.124    22.394   -4.423   39.300   0.0      0     0.006                                          0.1671E-02
 22  7 0.7270  237.971    22.394   -4.423   39.300   0.0      0     0.008                                          0.4084E-02
 22  8 0.8536  242.945    22.394   -4.423   39.300   0.0      0     0.004                                          0.2494E-02
 22  9 0.9455  246.558    22.394   -4.423   39.300   0.0      0     0.002                                          0.1159E-02
 22 10 0.9938  248.458    22.394   -4.423   39.300   0.0      0     0.000                                          0.2236E-03

                                     PANEL NO.   8                UPPER NACELLE

 23  1 0.0062  209.642    23.863    2.536   39.300   0.0000   1    -0.011     1.447    0.037   -30.00   -0.0066  -0.2716E-01  0.0      0.10885
 23  2 0.0545  211.542    23.863    2.536   39.300   0.0000   1    -0.048                                         0.1241E-01
 23  3 0.1464  215.155    23.863    2.536   39.300   0.0000   1    -0.050                                         0.2170E-01
 23  4 0.2730  220.129    23.863    2.536   39.300   0.0000   1    -0.048                                         0.2082E-01
 23  5 0.4218  225.976    23.863    2.536   39.300   0.0000   1    -0.048                                         0.2182E-01
 23  6 0.5782  232.124    23.863    2.536   39.300  -0.0000   1    -0.037                                         0.1615E-01
 23  7 0.7270  237.971    23.863    2.536   39.300  -0.0000   1    -0.025                                         0.1045E-01
 23  8 0.8536  242.945    23.863    2.536   39.300  -0.0000   1    -0.022                                         0.6180E-02
 23  9 0.9455  246.558    23.863    2.536   39.300  -0.0000   1    -0.019                                         0.3631E-02
 23 10 0.9938  248.458    23.863    2.536   39.300  -0.0000   1    -0.014                                         0.1247E-02

 24  1 0.0062  209.642    25.332   -0.008   39.300   0.0000   1     0.195     1.206    0.031   -90.00   -0.0003  -0.2419E 00  0.0      0.00000
 24  2 0.0545  211.542    25.332   -0.008   39.300   0.0000   1    -0.011                                        -0.1973E-01
 24  3 0.1464  215.155    25.332   -0.008   39.300   0.0000   1    -0.047                                         0.1982E-01
 24  4 0.2730  220.129    25.332   -0.008   39.300   0.0000   1    -0.053                                         0.2307E-01
 24  5 0.4218  225.976    25.332   -0.008   39.300   0.0000   1    -0.052                                         0.2539E-01
 24  6 0.5782  232.124    25.332   -0.008   39.300  -0.0000   1    -0.042                                         0.1842E-01
 24  7 0.7270  237.971    25.332   -0.008   39.300  -0.0000   1    -0.030                                         0.1060E-01
 24  8 0.8536  242.945    25.332   -0.008   39.300  -0.0000   1    -0.019                                         0.4655E-02
 24  9 0.9455  246.558    25.332   -0.008   39.300  -0.0000   1    -0.014                                         0.2038E-02
 24 10 0.9938  248.458    25.332   -0.008   39.300  -0.0000   1    -0.012                                         0.6064E-03

 25  1 0.0062  209.642    23.863   -2.552   39.300   0.0000   1     0.143     0.943    0.024  -150.00   -0.0064  -0.1463E 00  0.0     -0.07120
 25  2 0.0545  211.542    23.863   -2.552   39.300   0.0000   1     0.023                                        -0.2605E-01
 25  3 0.1464  215.155    23.863   -2.552   39.300   0.0000   1    -0.044                                         0.2647E-01
 25  4 0.2730  220.129    23.863   -2.552   39.300   0.0000   1    -0.043                                         0.1400E-01
 25  5 0.4218  225.976    23.863   -2.552   39.300   0.0000   1    -0.053                                         0.2819E-01
 25  6 0.5782  232.124    23.863   -2.552   39.300  -0.0000   1    -0.035                                         0.1428E-01
 25  7 0.7270  237.971    23.863   -2.552   39.300  -0.0000   1    -0.021                                         0.6713E-02
 25  8 0.8536  242.945    23.863   -2.552   39.300  -0.0000   1    -0.008                                        -0.6931E-03
 25  9 0.9455  246.558    23.863   -2.552   39.300  -0.0000   1    -0.006                                        -0.1739E-02
 25 10 0.9938  248.458    23.863   -2.552   39.300  -0.0000   1    -0.006                                        -0.8934E-03

 26  1 0.0062  209.642    20.925   -2.552   39.300   0.0000   1    -0.407     2.249    0.057   150.00   -0.0027   0.2994E 00  0.0     -0.16960
 26  2 0.0545  211.542    20.925   -2.552   39.300   0.0000   1    -0.235                                         0.1539E 00
 26  3 0.1464  215.155    20.925   -2.552   39.300   0.0000   1    -0.096                                         0.4018E-01
 26  4 0.2730  220.129    20.925   -2.552   39.300   0.0000   1    -0.042                                         0.8997E-02
 26  5 0.4218  225.976    20.925   -2.552   39.300   0.0000   1    -0.046                                         0.2575E-01
 26  6 0.5782  232.124    20.925   -2.552   39.300  -0.0000   1    -0.028                                         0.1094E-01
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-32/-24 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  0.500    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  C  X/C        X        Y         Z      CHORD    SLOPE   ITS      DCP      CNC     CN      DL      CMT        GAMMA      CTC       CDC

 26  7 0.7270 237.971  20.925   -2.552   39.300 -0.0000   1    -0.013                                        0.2081E-02
 26  8 0.8536 242.945  20.925   -2.552   39.300 -0.0000   1    -0.003                                       -0.3606E-02
 26  9 0.9455 246.558  20.925   -2.552   39.300 -0.0000   1    -0.003                                       -0.3010E-02
 26 10 0.9938 248.456  20.925   -2.552   39.300 -0.0000   1    -0.005                                       -0.1065E-02

 27  1 0.0062 209.642  19.456   -0.008   39.300  0.0000   1    -0.371   1.867  0.047   90.00  -0.0011   0.3705E 00  0.0     -0.00000
 27  2 0.0545 211.542  19.456   -0.008   39.300  0.0000   1    -0.119                                        0.8428E-01
 27  3 0.1464 215.155  19.456   -0.008   39.300  0.0000   1    -0.067                                        0.3247E-01
 27  4 0.2730 220.129  19.456   -0.008   39.300  0.0000   1    -0.044                                        0.1629E-01
 27  5 0.4218 225.976  19.456   -0.008   39.300  0.0000   1    -0.040                                        0.1981E-01
 27  6 0.5782 232.124  19.456   -0.008   39.300 -0.0000   1    -0.029                                        0.1150E-01
 27  7 0.7270 237.971  19.456   -0.008   39.300 -0.0000   1    -0.024                                        0.8465E-02
 27  8 0.8536 242.945  19.456   -0.008   39.300 -0.0000   1    -0.013                                        0.7704E-03
 27  9 0.9455 246.558  19.456   -0.008   39.300 -0.0000   1    -0.011                                        0.3280E-03
 27 10 0.9938 248.456  19.456   -0.008   39.300 -0.0000   1    -0.010                                        0.5667E-03

 28  1 0.0062 209.642  20.925    2.536   39.300  0.0000   1    -0.229   1.297  0.033   30.00  -0.0013   0.2024E 00  0.0      0.09750
 28  2 0.0545 211.542  20.925    2.536   39.300  0.0000   1    -0.073                                        0.5311E-01
 28  3 0.1464 215.155  20.925    2.536   39.300  0.0000   1    -0.046                                        0.2695E-01
 28  4 0.2730 220.129  20.925    2.536   39.300  0.0000   1    -0.034                                        0.1860E-01
 28  5 0.4218 225.976  20.925    2.536   39.300  0.0000   1    -0.030                                        0.1930E-01
 28  6 0.5782 232.124  20.925    2.536   39.300 -0.0000   1    -0.022                                        0.1349E-01
 28  7 0.7270 237.971  20.925    2.536   39.300 -0.0000   1    -0.017                                        0.9304E-02
 28  8 0.8536 242.945  20.925    2.536   39.300 -0.0000   1    -0.010                                        0.4754E-02
 28  9 0.9455 246.558  20.925    2.536   39.300 -0.0000   1    -0.007                                        0.2843E-02
 28 10 0.9938 248.456  20.925    2.536   39.300 -0.0000   1    -0.004                                        0.1072E-02

                              PANEL NO.   9                 LOWER NACELLE PYLON

 29  1 0.0062 209.343  22.394   -6.323   39.400  0.0      0     0.151   0.774  0.020  -90.00   0.0038   0.7593E-01  0.0      0.00000
 29  2 0.0545 211.747  22.394   -6.323   39.400  0.0      0     0.192                                        0.9640E-01
 29  3 0.1464 214.870  22.394   -6.323   39.400  0.0      0     0.031                                        0.1538E-01
 29  4 0.2730 219.856  22.394   -6.323   39.400  0.0      0    -0.006                                       -0.3160E-02
 29  5 0.4218 225.718  22.394   -6.323   39.400  0.0      0    -0.008                                       -0.4180E-02
 29  6 0.5782 231.882  22.394   -6.323   39.400  0.0      0     0.007                                        0.3650E-02
 29  7 0.7270 237.744  22.394   -6.323   39.400  0.0      0    -0.005                                       -0.2505E-02
 29  8 0.8536 242.730  22.394   -6.323   39.400  0.0      0     0.004                                        0.1822E-02
 29  9 0.9455 246.353  22.394   -6.323   39.400  0.0      0     0.002                                        0.1040E-02
 29 10 0.9938 248.257  22.394   -6.323   39.400  0.0      0     0.000                                        0.2113E-03

                              PANEL NO.  10                LOWER NACELLE

 30  1 0.0062 209.343  23.780   -8.000   39.400 -0.0000   1     0.108  -1.580 -0.040  -30.00   0.0021  -0.7645E-01  0.0     -0.11927
 30  2 0.0545 211.747  23.780   -8.000   39.400 -0.0000   1     0.060                                       -0.3404E-01
 30  3 0.1464 214.870  23.780   -8.000   39.400 -0.0000   1     0.082                                       -0.5859E-01
 30  4 0.2730 219.856  23.780   -8.000   39.400  0.0000   1     0.050                                       -0.2494E-01
 30  5 0.4218 225.718  23.780   -8.000   39.400  0.0000   1     0.063                                       -0.4403E-01
 30  6 0.5782 231.882  23.780   -8.000   39.400  0.0000   1     0.032                                       -0.1635E-01
 30  7 0.7270 237.744  23.780   -8.000   39.400  0.0000   1     0.017                                       -0.9219E-02
 30  8 0.8536 242.730  23.780   -8.000   39.400  0.0000   1     0.000                                        0.1367E-02
 30  9 0.9455 246.353  23.780   -8.000   39.400  0.0000   1    -0.002                                        0.2310E-02
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1807-32/-24 WING) WITH D/H NACELLES. (1/10 SCALE).

MACH =  0.500     ALPHA =  5.000 DG     PSI =  0.0   DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

 S  C  X/C       X        Y        Z      CHORD    SLOPE  ITS     DCP      CNC     CN      DL      CMT       GAMMA      CTC      CDC


30 10 0.9938 248.257  23.780  -8.000   39.400  0.0000  1    -0.001                                     0.1073E-02

31  1 0.0062 209.343  25.165 -10.400   39.400 -0.0000  1    -0.076   -1.718 -0.044  -90.00   0.0068   0.1174E 00  0.0    -0.00000
31  2 0.0545 211.247  25.165 -10.400   39.400 -0.0000  1     0.056                                    -0.2153E-01
31  3 0.1464 214.870  25.165 -10.400   39.400 -0.0000  1     0.071                                    -0.4249E-01
31  4 0.2730 219.856  25.165 -10.400   39.400  0.0000  1     0.069                                    -0.4063E-01
31  5 0.4218 225.718  25.165 -10.400   39.400  0.0000  1     0.063                                    -0.3916E-01
31  6 0.5782 231.882  25.165 -10.400   39.400  0.0000  1     0.047                                    -0.2656E-01
31  7 0.7270 237.744  25.165 -10.400   39.400  0.0000  1     0.030                                    -0.1477E-01
31  8 0.8536 242.730  25.165 -10.400   39.400  0.0000  1     0.016                                    -0.5989E-02
31  9 0.9455 246.353  25.165 -10.400   39.400  0.0000  1     0.009                                    -0.2345E-02
31 10 0.9938 248.257  25.165 -10.400   39.400  0.0000  1     0.007                                    -0.6535E-03

32  1 0.0062 209.343  23.780 -12.800   39.400 -0.0000  1     0.017   -1.774 -0.048 -150.00   0.0071   0.2733E-01  0.0     0.13467
32  2 0.0545 211.247  23.780 -12.800   39.400 -0.0000  1     0.061                                    -0.2999E-01
32  3 0.1464 214.870  23.780 -12.800   39.400 -0.0000  1     0.066                                    -0.3497E-01
32  4 0.2730 219.856  23.780 -12.800   39.400  0.0000  1     0.067                                    -0.3691E-01
32  5 0.4218 225.718  23.780 -12.800   39.400  0.0000  1     0.056                                    -0.3671E-01
32  6 0.5782 231.882  23.780 -12.800   39.400  0.0000  1     0.048                                    -0.2561E-01
32  7 0.7270 237.744  23.780 -12.800   39.400  0.0000  1     0.032                                    -0.1596E-01
32  8 0.8536 242.730  23.780 -12.800   39.400  0.0000  1     0.023                                    -0.9811E-02
32  9 0.9455 246.353  23.780 -12.800   39.400  0.0000  1     0.016                                    -0.5653E-02
32 10 0.9938 248.257  23.780 -12.800   39.400  0.0000  1     0.012                                    -0.1959E-02

33  1 0.0062 209.343  21.008 -12.800   39.400 -0.0000  1     0.179   -1.623 -0.046  150.00   0.0044  -0.1384E 00  0.0     0.13762
33  2 0.0545 211.247  21.008 -12.800   39.400 -0.0000  1     0.082                                    -0.5676E-01
33  3 0.1464 214.870  21.008 -12.800   39.400 -0.0000  1     0.063                                    -0.3425E-01
33  4 0.2730 219.856  21.008 -12.800   39.400  0.0000  1     0.054                                    -0.3232E-01
33  5 0.4218 225.718  21.008 -12.800   39.400  0.0000  1     0.049                                    -0.3200E-01
33  6 0.5782 231.882  21.008 -12.800   39.400  0.0000  1     0.036                                    -0.2273E-01
33  7 0.7270 237.744  21.008 -12.800   39.400  0.0000  1     0.029                                    -0.1399E-01
33  8 0.8536 242.730  21.008 -12.800   39.400  0.0000  1     0.021                                    -0.9025E-02
33  9 0.9455 246.353  21.008 -12.800   39.400  0.0000  1     0.018                                    -0.5145E-02
33 10 0.9938 248.257  21.008 -12.800   39.400  0.0000  1     0.011                                    -0.1722E-02

34  1 0.0062 209.343  19.623 -10.400   39.400 -0.0000  1     0.278   -1.838 -0.047   90.00   0.0022  -0.2695E 00  0.0     0.00000
34  2 0.0545 211.247  19.623 -10.400   39.400 -0.0000  1     0.104                                    -0.8659E-01
34  3 0.1464 214.870  19.623 -10.400   39.400 -0.0000  1     0.064                                    -0.3930E-01
34  4 0.2730 219.856  19.623 -10.400   39.400  0.0000  1     0.050                                    -0.2832E-01
34  5 0.4218 225.718  19.623 -10.400   39.400  0.0000  1     0.048                                    -0.3063E-01
34  6 0.5782 231.882  19.623 -10.400   39.400  0.0000  1     0.038                                    -0.2107E-01
34  7 0.7270 237.744  19.623 -10.400   39.400  0.0000  1     0.023                                    -0.1047E-01
34  8 0.8536 242.730  19.623 -10.400   39.400  0.0000  1     0.014                                    -0.5772E-02
34  9 0.9455 246.353  19.623 -10.400   39.400  0.0000  1     0.009                                    -0.2266E-02
34 10 0.9938 248.257  19.623 -10.400   39.400  0.0000  1     0.006                                    -0.3666E-03

35  1 0.0062 209.343  21.008  -8.000   39.400 -0.0000  1     0.267   -2.043 -0.052   20.00  -0.0010  -0.2372E 00  0.0    -0.15421
35  2 0.0545 211.247  21.008  -8.000   39.400 -0.0000  1     0.188                                    -0.1518E 00
35  3 0.1464 214.870  21.008  -8.000   39.400 -0.0000  1     0.097                                    -0.5357E-01
35  4 0.2730 219.856  21.008  -8.000   39.400  0.0000  1     0.043                                    -0.1639E-01
35  5 0.4218 225.718  21.008  -8.000   39.400  0.0000  1     0.054                                    -0.3914E-01
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1A07-37/-24 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  0.500    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  C  X/C        X        Y        Z      CHORD    SLOPE  ITS     DCP      CNC     CN      PL      CMT        GAMMA       CTC        CDC

 35  6 0.5782 231.882  21.008   -8.000   39.400   0.0000  1     0.033                                          -0.1904E-01
 35  7 0.7270 237.744  21.008   -8.000   39.400   0.0000  1     0.013                                          -0.4627E-02
 35  8 0.8536 242.730  21.008   -8.000   39.400   0.0000  1     0.003                                          -0.1426E-03
 35  9 0.9455 246.353  21.009   -9.000   39.400   0.0000  1     0.001                                           0.1356E-02
 35 10 0.9938 248.757  21.009   -9.000   39.400   0.0000  1     0.001                                           0.9059E-03

                                  PANEL NO.  11     0           FIN PANEL NO.  1

 36  1 0.0062 249.558  64.500   -9.100   18.782   0.0     0     2.454    5.477  0.292   90.00   0.0112   0.1232E 01  0.0        0.00000
 36  2 0.0545 250.466  64.500   -9.100   18.782   0.0     0     0.825                                           0.4189E 00
 36  3 0.1464 252.193  64.500   -9.100   18.782   0.0     0     0.513                                           0.2576E 00
 36  4 0.2730 254.576  64.500   -9.100   18.782   0.0     0     0.328                                           0.1694E 00
 36  5 0.4218 257.365  64.500   -9.100   18.782   0.0     0     0.214                                           0.1072E 00
 36  6 0.5782 260.303  64.500   -9.100   18.782   0.0     0     0.126                                           0.6322E-01
 36  7 0.7270 263.097  64.500   -9.100   18.782   0.0     0     0.069                                           0.3486E-01
 36  8 0.8536 265.474  64.500   -9.100   18.782   0.0     0     0.028                                           0.1769E-01
 36  9 0.9455 267.201  64.500   -9.100   18.782   0.0     0     0.018                                           0.7774E-02
 36 10 0.9938 268.109  64.500   -9.100   18.782   0.0     0     0.008                                           0.2299E-02

 37  1 0.0062 252.435  64.500   -7.300   17.447   0.0     0     2.312    4.497  0.258   90.00   0.0156   0.1196E 01  0.0        0.00000
 37  2 0.0545 253.278  64.500   -7.300   17.447   0.0     0     0.794                                           0.3987E 00
 37  3 0.1464 254.862  64.500   -7.300   17.447   0.0     0     0.455                                           0.2284E 00
 37  4 0.2730 257.091  64.500   -7.300   17.447   0.0     0     0.286                                           0.1424E 00
 37  5 0.4218 259.696  64.500   -7.300   17.447   0.0     0     0.168                                           0.9425E-01
 37  6 0.5782 262.416  64.500   -7.300   17.447   0.0     0     0.091                                           0.4554E-01
 37  7 0.7270 265.011  64.500   -7.300   17.447   0.0     0     0.046                                           0.2373E-01
 37  8 0.8536 267.220  64.500   -7.300   17.447   0.0     0     0.023                                           0.1146E-01
 37  9 0.9455 268.824  64.500   -7.300   17.447   0.0     0     0.011                                           0.5352E-02
 37 10 0.9938 269.667  64.500   -7.300   17.447   0.0     0     0.003                                           0.1610E-02

 38  1 0.0062 255.311  64.500   -5.500   16.112   0.0     0     2.278    3.477  0.216   90.00   0.0191   0.1142E 01  0.0        0.00000
 38  2 0.0545 256.040  64.500   -5.500   16.112   0.0     0     0.742                                           0.3774E 00
 38  3 0.1464 257.572  64.500   -5.500   16.112   0.0     0     0.401                                           0.2015E 00
 38  4 0.2730 259.611  64.500   -5.500   16.112   0.0     0     0.222                                           0.1114E 00
 38  5 0.4218 262.008  64.500   -5.500   16.112   0.0     0     0.111                                           0.5578E-01
 38  6 0.5782 264.524  64.500   -5.500   16.112   0.0     0     0.054                                           0.2707E-01
 38  7 0.7270 266.926  64.500   -5.500   16.112   0.0     0     0.027                                           0.1340E-01
 38  8 0.8536 268.965  64.500   -5.500   16.112   0.0     0     0.013                                           0.6685E-02
 38  9 0.9455 270.447  64.500   -5.500   16.112   0.0     0     0.006                                           0.3165E-02
 38 10 0.9938 271.226  64.500   -5.500   16.112   0.0     0     0.002                                           0.9604E-03

 39  1 0.0062 258.188  64.500   -3.700   14.778   0.0     0     2.046    2.283  0.155   90.00   0.0200   0.1027E 01  0.0        0.00000
 39  2 0.0545 258.902  64.500   -3.700   14.778   0.0     0     0.620                                           0.3161E 00
 39  3 0.1464 260.261  64.500   -3.700   14.778   0.0     0     0.277                                           0.1367E 00
 39  4 0.2730 262.131  64.500   -3.700   14.779   0.0     0     0.111                                           0.5551E-01
 39  5 0.4218 264.330  64.500   -3.700   14.778   0.0     0     0.046                                           0.2417E-01
 39  6 0.5782 266.641  64.500   -3.700   14.778   0.0     0     0.023                                           0.1163E-01
 39  7 0.7270 268.840  64.500   -3.700   14.778   0.0     0     0.012                                           0.5905E-02
 39  8 0.8536 270.710  64.500   -3.700   14.778   0.0     0     0.006                                           0.3018E-02
 39  9 0.9455 272.069  64.500   -3.700   14.778   0.0     0     0.003                                           0.1456E-02
 39 10 0.9938 272.783  64.500   -3.700   14.778   0.0     0     0.001                                           0.4500E-03

END OF CASE
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TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1807-32/-74 WING) WITH C/D NACELLES. (1/10 SCALE).

MACH =  2.550

ALPHA =  5.000 DEG.
PSI =  0.0   DEG.

PITCH RATE =   0.0  DEG /SEC
ROLL RATE =   0.0  DEG /SEC
YAW RATE =   0.0  DEG /SEC


ANALYSIS (DIRECT) CASE   (INVERS = 0)


MOMENT AND ROTATION CENTER  :   XBAR =  0.19104E 03    ZBAR = -0.54500E 01  *****  YINF =  0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT


VORTEX WAKE FLOATATION PARAMETERS :  FLOATX = 0.0      FLOATY = 0.0



CN REFERENCED TO SURF;  CL,CY,CD,CT,CS REFERENCED TO SREF;  CM REFERENCED TO SREF*CBAR;  CRM,CYM REFERENCED TO SREF*WSPAN

  I   SURF/SREF      CN(I)       CL(I)       CY(I)       CD(I)       CT(I)       CS(I)          CM(I)        CRM(I)        CYM(I)

  1  0.7839E 00   -0.00129     0.00664     0.00080     0.00145     0.0         0.0          0.2739E-02   0.1020E-02   0.1185E-01
  2  0.1941E 00    0.14962     0.02885    -0.03609     0.00904     0.00036     0.00122      0.6352E-02   0.3245E-02  -0.3192E-03
  3  0.7703E-01    0.20611     0.01563     0.00744     0.00132     0.00026     0.00038     -0.5579E-04   0.3289E-02  -0.2688E-03
  4  0.3126E-01    0.25130     0.00773     0.00125     0.00060     0.00004     0.00022     -0.9304E-03   0.2081E-02  -0.4279E-04
  5  0.5194E-01    0.30532     0.01574     0.00167     0.00111     0.00031     0.00009     -0.4589E-02   0.5263E-02   0.2622E-04
  6  0.4142E-01    0.36326     0.01446     0.00097     0.00124     0.0         0.0         -0.7995E-02   0.6560E-02  -0.1306E-03
  7  0.8313E-02   -0.01778    -0.00006    -0.00018    -0.00000     0.0         0.0          0.3722E-10  -0.8562E-06  -0.2329E-04
  8  0.8265E-01   -0.00578     0.00032    -0.00007     0.00003     0.0         0.0         -0.5924E-04   0.5659E-04  -0.1811E-04
  9  0.7138E-02   -0.00304    -0.00000    -0.00002    -0.00000     0.0         0.0          0.1567E-10  -0.1000E-05  -0.9749E-05
 10  0.7817E-01   -0.00922     0.00000     0.00014     0.00001     0.0         0.0          0.1419E-04   0.2749E-04   0.6441E-04
 11  0.1249E-01    0.14356     0.00000    -0.00179     0.00000     0.0         0.0         -0.1596E-08  -0.1107E-03  -0.9918E-03

     SREF        WSPAN        CBAR          CLTOT        CDTOT        CYTOT     CMTOT          CRMTOT        CYMTOT

  0.96768E 04  0.12900E 03  0.16223E 03    0.19003      0.01859      0.0      -0.92462E-02   0.0           0.0


CD/CL**2 = 0.5736     E = 0.3227
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-72/-24 WING) WITH D/U NACELLES. (1/10 SCALE).

MACH =  2.550    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

 S  C  X/C        X        Y         Z     CHORD     SLOPE  ITS       DCP        CNC      CN      CL       CMT        GAMMA      CTC       CDC


                                  PANEL NO.   1               FUSELAGE (FUSIFORM PANEL)

 1  1 0.0003    0.094    0.107   -2.400 352.400   0.6675  1      1.435      2.401  0.707  -27.50   -0.0088 -0.4169E 00  0.0       0.75721
 1  2 0.0024    0.848    0.321   -1.985 352.400   0.2589  1      0.718                                      -0.2249E 00
 1  3 0.0067    2.353    0.532   -1.583 352.400   0.2547  1      0.292                                      -0.1379E 00
 1  4 0.0131    4.603    0.741   -1.182 352.400   0.2017  1      0.229                                      -0.1463E 00
 1  5 0.0215    7.597    0.945   -0.790 352.400   0.1650  1      0.185                                      -0.1138E 00
 1  6 0.0320   11.293    1.143   -0.409 352.400   0.1455  1      0.137                                      -0.9129E-01
 1  7 0.0446   15.766    1.327   -0.057 352.400   0.1300  1      0.147                                      -0.9295E-01
 1  8 0.0590   20.805    1.512    0.298 352.400   0.1161  1      0.131                                      -0.9117E-01
 1  9 0.0754   26.570    1.701    0.652 352.400   0.1035  1      0.114                                      -0.6701E-01
 1 10 0.0936   32.976    1.891    1.027 352.400   0.0826  1      0.085                                      -0.4865E-01
 1 11 0.1135   39.995    2.078    1.386 352.400   0.0656  1      0.073                                      -0.4291E-01
 1 12 0.1351   47.590    2.256    1.729 352.400   0.0486  1      0.064                                      -0.3378E-01
 1 13 0.1582   55.751    2.470    2.043 352.400   0.0355  1      0.047                                      -0.1284E-01
 1 14 0.1828   64.420    2.575    2.343 352.400   0.0251  1      0.031                                      -0.4579E-02
 1 15 0.2088   73.567    2.756    2.689 352.400   0.0121  1      0.023                                      -0.1698E-02
 1 16 0.2360   83.154    2.933    3.029 352.400  -0.0434  1     -0.015                                       0.2974E-01
 1 17 0.2643   93.140    2.941    3.045 352.400  -0.0481  1     -0.010                                       0.2170E-01
 1 18 0.2936  103.481    2.941    3.045 352.400  -0.0306  1      0.014                                       0.2208E-02
 1 19 0.3239  114.133    2.941    3.045 352.400  -0.0288  1      0.017                                       0.4363E-03
 1 20 0.3549  125.051    2.941    3.045 352.400  -0.0302  1     -0.006                                       0.1092E-01
 1 21 0.3865  136.189    2.941    3.045 352.400  -0.0330  1     -0.026                                       0.1942E-01
 1 22 0.4186  147.447    2.942    3.045 352.400  -0.0319  1     -0.037                                       0.1869E-01
 1 23 0.4510  158.924    2.941    3.045 352.400  -0.0314  1     -0.041                                       0.2961E-01
 1 24 0.4836  170.434    2.941    3.045 352.400  -0.0287  1     -0.036                                       0.1919E-01
 1 25 0.5164  181.965    2.941    3.045 352.400  -0.0304  1     -0.040                                       0.3047E-01
 1 26 0.5490  193.470    2.941    3.045 352.400  -0.0329  1     -0.042                                       0.3887E-01
 1 27 0.5814  204.902    2.941    3.045 352.400  -0.0309  1     -0.032                                       0.2719E-01
 1 28 0.6135  216.210    2.941    3.045 352.400  -0.0251  1     -0.038                                       0.3714E-01
 1 29 0.6451  227.348    2.942    3.045 352.400  -0.0146  1     -0.018                                       0.1977E-01
 1 30 0.6761  238.266    2.941    3.045 352.400  -0.0107  1     -0.009                                       0.2929E-02
 1 31 0.7066  248.918    2.941    3.045 352.400  -0.0020  1     -0.015                                       0.1857E-01
 1 32 0.7357  259.259    2.941    3.045 352.400   0.0015  1     -0.010                                       0.1604E-01
 1 33 0.7640  269.245    2.950    3.063 352.400  -0.0343  1     -0.043                                       0.4749E-01
 1 34 0.7912  278.832    2.808    2.790 352.400  -0.0211  1     -0.005                                       0.1003E-01
 1 35 0.8172  287.979    2.644    2.474 352.400  -0.0108  1     -0.022                                       0.3563E-01
 1 36 0.8418  296.648    2.489    2.176 352.400  -0.0084  1     -0.013                                       0.3149E-01
 1 37 0.8649  304.801    2.333    1.875 352.400  -0.0119  1     -0.025                                       0.3492E-01
 1 38 0.8865  312.404    2.163    1.551 352.400  -0.0089  1     -0.013                                       0.1252E-01
 1 39 0.9064  319.423    1.988    1.214 352.400  -0.0079  1     -0.036                                       0.3112E-01
 1 40 0.9246  325.829    1.807    0.865 352.400  -0.0079  1     -0.057                                       0.4492E-01
 1 41 0.9410  331.594    1.630    0.525 352.400   0.0075  1     -0.057                                       0.3928E-01
 1 42 0.9554  336.694    1.496    0.269 352.400  -0.0156  1     -0.086                                       0.7724E-01
 1 43 0.9680  341.106    1.327   -0.056 352.400  -0.0457  1     -0.117                                       0.1044E 00
 1 44 0.9785  344.813    1.126   -0.442 352.400  -0.0887  1     -0.154                                       0.1695E 00
 1 45 0.9869  347.797    0.901   -0.875 352.400  -0.1576  1     -0.154                                       0.2872E 00
 1 46 0.9933  350.046    0.656   -1.345 352.400  -0.2912  1     -0.154                                       0.2466E 00
 1 47 0.9976  351.551    0.399   -1.840 352.400  -0.6851  1     -0.062                                       0.1325E 00
 1 48 0.9997  352.305    0.133   -2.351 352.400  -1.7262  1      1.486                                       0.5511E-01
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (LL1607-327-24 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  2.550     ALPHA =  5.000 DG     PSI =  0.0    DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

  S  C  X/C        X        Y         Z      CHORD    SLOPE   ITS      DCP       CNL      CN       DL       CMT       GAMMA       CTC       CDC


  2  1 0.0003    0.094    0.227   -2.583  352.400   0.6087  1      1.378     4.553  0.013   -84.37   -0.0117 -0.4354E 00  0.0       0.57313
  2  2 0.0024    0.842    0.679   -2.538  352.400   0.3053  1      0.688                                     -0.2410E 00
  2  3 0.0067    2.353    1.127   -2.494  352.400   0.2032  1      0.280                                     -0.1594E 00
  2  4 0.0131    4.603    1.564   -2.451  352.400   0.1514  1      0.193                                     -0.1430E 00
  2  5 0.0215    7.587    2.001   -2.408  352.400   0.1147  1      0.142                                     -0.1123E 00
  2  6 0.0320   11.243    2.421   -2.367  352.400   0.0435  1      0.168                                     -0.1377E 00
  2  7 0.0446   15.706    2.804   -2.329  352.400   0.0828  1      0.122                                     -0.1043E 00
  2  8 0.0590   20.805    3.201   -2.290  352.400   0.0743  1      0.113                                     -0.9598E-01
  2  9 0.0754   26.576    3.602   -2.250  352.400   0.0674  1      0.114                                     -0.9397E-01
  2 10 0.0936   32.976    4.006   -2.210  352.400   0.0603  1      0.109                                     -0.7695E-01
  2 11 0.1135   39.995    4.400   -2.171  352.400   0.0515  1      0.081                                     -0.6320E-01
  2 12 0.1351   47.598    4.777   -2.134  352.400   0.0437  1      0.069                                     -0.2787E-01
  2 13 0.1582   55.751    5.124   -2.100  352.400   0.0356  1      0.061                                     -0.3600E-01
  2 14 0.1828   64.420    5.454   -2.067  352.400   0.0365  1      0.059                                     -0.3248E-01
  2 15 0.2088   73.567    5.936   -2.130  352.400   0.0361  1      0.056                                     -0.3123E-01
  2 16 0.2360   83.154    6.211   -1.993  352.400  -0.0044  1      0.012                                      0.3473E-02
  2 17 0.2643   93.140    6.228   -1.991  352.400  -0.0052  1      0.012                                      0.5023E-02
  2 18 0.2936  103.481    6.226   -1.991  352.400  -0.0033  1     -0.012                                      0.2698E-01
  2 19 0.3239  114.133    6.229   -1.991  352.400  -0.0032  1     -0.038                                      0.4045E-01
  2 20 0.3549  125.051    6.229   -1.991  352.400  -0.0033  1     -0.048                                      0.3924E-01
  2 21 0.3865  136.189    6.229   -1.991  352.400  -0.0037  1     -0.026                                      0.9064E-02
  2 22 0.4186  147.497    6.229   -1.991  352.400  -0.0025  1     -0.053                                      0.4101E-01
  2 23 0.4510  158.924    6.228   -1.991  352.400  -0.0025  1     -0.021                                      0.9813E-02
  2 24 0.4836  170.424    6.228   -1.991  352.400  -0.0032  1     -0.042                                      0.3927E-01
  2 25 0.5164  181.965    6.226   -1.991  352.400  -0.0034  1     -0.067                                      0.3971E-01
  2 26 0.5490  193.470    6.228   -1.991  352.400  -0.0026  1     -0.046                                      0.9032E-02
  2 27 0.5814  204.902    6.229   -1.991  352.400  -0.0034  1     -0.080                                      0.7698E-01
  2 28 0.6135  216.210    6.228   -1.991  352.400  -0.0028  1     -0.014                                     -0.5549E-02
  2 29 0.6451  227.346    6.229   -1.991  352.400  -0.0016  1     -0.020                                      0.1957E-01
  2 30 0.6761  238.266    6.228   -1.991  352.400  -0.0012  1     -0.043                                      0.4460E-01
  2 31 0.7064  248.918    6.228   -1.991  352.400  -0.0002  1     -0.002                                     -0.2392E-02
  2 32 0.7357  259.254    6.228   -1.991  352.400   0.0007  1     -0.003                                      0.5548E-02
  2 33 0.7640  269.245    6.249   -1.984  352.400  -0.0407  1     -0.020                                      0.2630E-01
  2 34 0.7912  278.832    5.947   -2.019  352.400  -0.0273  1     -0.035                                      0.4740E-01
  2 35 0.8172  287.974    5.599   -2.053  352.400  -0.0351  1     -0.031                                      0.4501E-01
  2 36 0.8418  296.648    5.270   -2.086  352.400  -0.0371  1     -0.034                                      0.4509E-01
  2 37 0.8649  304.901    4.939   -2.118  352.400  -0.0429  1     -0.054                                      0.6368E-01
  2 38 0.8865  312.404    4.581   -2.154  352.400  -0.0481  1     -0.060                                      0.6350E-01
  2 39 0.9064  319.423    4.210   -2.190  352.400  -0.0543  1     -0.063                                      0.5969E-01
  2 40 0.9246  325.829    3.826   -2.228  352.400  -0.0589  1     -0.070                                      0.6145E-01
  2 41 0.9410  331.594    3.451   -2.265  352.400  -0.0473  1     -0.075                                      0.6611E-01
  2 42 0.9554  336.694    3.168   -2.293  352.400  -0.0742  1     -0.086                                      0.7758E-01
  2 43 0.9680  341.106    2.810   -2.328  352.400  -0.1075  1     -0.120                                      0.1273E 00
  2 44 0.9785  344.813    2.385   -2.370  352.400  -0.1527  1     -0.146                                      0.1810E 00
  2 45 0.9869  347.797    1.907   -2.417  352.400  -0.2228  1     -0.154                                      0.3029E 00
  2 46 0.9933  350.046    1.389   -2.468  352.400  -0.3557  1     -0.154                                      0.2270E 00
  2 47 0.9976  351.551    0.844   -2.522  352.400  -0.7438  1      0.035                                      0.1219E 00
  2 48 0.9997  352.305    0.281   -2.578  352.400  -1.7670  1      1.681                                      0.7176E-01

  3  1 0.0003    0.094    0.120   -2.789  352.400   0.5277  1      1.282    -7.356 -0.021  -146.87   -0.0041 -0.4515E 00  0.0       1.25124
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-337-24 WING) WITH O/H NACELLES. (1/10 SCALE).

MACH =  2.550     ALPHA =  5.000 DG     PSI =  0.0   DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

 S  C  X/C        X        Y         Z     CHORD    SLOPE  ITS     DCP       CNC      CN       CL      CMT         GAMMA        CTC      CDC


 3  2 0.0024    0.846    0.358   -2.184 352.400   0.2364  1      0.603                                          -0.2559E 00
 3  3 0.0067    2.353    0.595   -3.517 352.400   0.1368  1      0.275                                          -0.1881E 00
 3  4 0.0131    4.603    0.829   -3.974 352.400   0.0892  1      0.197                                          -0.1689E 00
 3  5 0.0215    7.557    1.054   -4.273 352.400   0.0492  1      0.177                                          -0.1617E 00
 3  6 0.0320   11.293    1.278   -4.561 352.400   0.0303  1      0.127                                          -0.1277E 00
 3  7 0.0446   15.706    1.483   -4.877 352.400   0.0254  1      0.118                                          -0.1143E 00
 3  8 0.0590   20.805    1.684   -5.193 352.400   0.0236  1      0.129                                          -0.1122E 00
 3  9 0.0754   26.576    1.961   -5.515 352.400   0.0234  1      0.114                                          -0.9825E-01
 3 10 0.0936   32.976    2.113   -5.843 352.400   0.0318  1      0.117                                          -0.9740E-01
 3 11 0.1135   39.995    2.332   -6.163 352.400   0.0334  1      0.093                                          -0.7546E-01
 3 12 0.1351   47.598    2.521   -6.408 352.400   0.0367  1      0.056                                          -0.5916E-01
 3 13 0.1582   55.751    2.704   -6.744 352.400   0.0350  1      0.070                                          -0.5299E-01
 3 14 0.1828   64.420    2.878   -7.015 352.400   0.0501  1      0.079                                          -0.6044E-01
 3 15 0.2088   73.567    3.080   -7.325 352.400   0.0639  1      0.077                                          -0.6141E-01
 3 16 0.2360   83.154    3.278   -7.677 352.400   0.0419  1      0.041                                          -0.3384E-01
 3 17 0.2643   93.140    3.287   -7.641 352.400   0.0454  1      0.022                                          -0.1618E-01
 3 18 0.2936  103.481    3.287   -7.641 352.400   0.0293  1      0.001                                           0.9614E-02
 3 19 0.3239  114.133    3.287   -7.642 352.400   0.0272  1      0.022                                          -0.7916E-02
 3 20 0.3549  125.051    3.287   -7.642 352.400   0.0284  1      0.032                                          -0.1719E-01
 3 21 0.3865  136.189    3.287   -7.641 352.400   0.0312  1      0.024                                          -0.1235E-01
 3 22 0.4186  147.497    3.287   -7.642 352.400   0.0301  1      0.052                                          -0.3861E-01
 3 23 0.4510  158.924    3.287   -7.641 352.400   0.0296  1      0.038                                          -0.2597E-01
 3 24 0.4836  170.434    3.287   -7.641 352.400   0.0271  1      0.049                                          -0.3706E-01
 3 25 0.5164  181.965    3.287   -7.641 352.400   0.0287  1      0.020                                          -0.2146E-01
 3 26 0.5490  193.476    3.287   -7.641 352.400   0.0311  1      0.032                                          -0.2433E-01
 3 27 0.5814  204.907    3.287   -7.641 352.400   0.0292  1      0.067                                          -0.4193E-01
 3 28 0.6135  216.210    3.287   -7.641 352.400   0.0237  1      0.037                                          -0.1122E-01
 3 29 0.6451  227.348    3.287   -7.642 352.400   0.0138  1      0.011                                          -0.6829E-02
 3 30 0.6761  238.266    3.287   -7.641 352.400   0.0101  1      0.036                                          -0.2694E-01
 3 31 0.7066  248.918    3.287   -7.641 352.400   0.0016  1      0.008                                           0.3594E-02
 3 32 0.7357  259.259    3.287   -7.641 352.400  -0.0014  1      0.030                                          -0.2146E-01
 3 33 0.7640  269.245    3.297   -7.657 352.400  -0.0476  1     -0.024                                           0.3513E-01
 3 34 0.7912  278.832    3.138   -7.414 352.400  -0.0558  1     -0.034                                           0.5268E-01
 3 35 0.8172  287.979    2.955   -7.132 352.400  -0.0632  1     -0.047                                           0.7341E-01
 3 36 0.8418  296.646    2.781   -6.867 352.400  -0.0708  1     -0.050                                           0.7428E-01
 3 37 0.8649  304.801    2.607   -6.594 352.400  -0.0811  1     -0.061                                           0.8461E-01
 3 38 0.8865  312.404    2.418   -6.310 352.400  -0.0936  1     -0.066                                           0.9045E-01
 3 39 0.9064  319.473    2.222   -6.010 352.400  -0.1082  1     -0.072                                           0.9759E-01
 3 40 0.9246  325.825    2.019   -5.699 352.400  -0.1181  1     -0.071                                           0.9289E-01
 3 41 0.9410  331.594    1.821   -5.345 352.400  -0.1117  1     -0.076                                           0.9567E-01
 3 42 0.9554  336.694    1.672   -5.167 352.400  -0.1423  1     -0.082                                           0.1352E 00
 3 43 0.9680  341.106    1.483   -4.877 352.400  -0.1787  1     -0.104                                           0.1465E 00
 3 44 0.9785  344.813    1.259   -4.534 352.400  -0.2758  1     -0.132                                           0.2208E 00
 3 45 0.9869  347.797    1.007   -4.148 352.400  -0.2960  1     -0.107                                           0.1878E 00
 3 46 0.9933  350.046    0.733   -3.729 352.400  -0.4258  1     -0.103                                           0.2161E 00
 3 47 0.9976  351.551    0.445   -3.288 352.400  -0.7499  1      0.185                                           0.1090E 00
 3 48 0.9997  352.305    0.149   -2.832 352.400  -1.7835  1      1.922                                           0.2966E-01

                                   PANEL NO.   2                WING PANEL NO. 1

 4  1 0.0062  101.747    8.951   -5.490 138.357  -0.0153  0      0.505    17.596   0.127    0.18   -0.0212   0.2537E 00  0.19952  1.98746
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# TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1407-32/-24 WING) WITH D/U NACELLES. (1/10 SCALE).

MACH =  2.550    ALPHA =  4.069 DG     PSI =  0.0   DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

  S  C  X/C       X        Y         Z      CHORD    SLOPE   ITS       DCP        CNC      CN        ML      CMT          GAMMA       CTC       CDC


  4  2 0.0545 108.433    8.551   -5.490 138.357 -0.0632   0        0.231                                           0.1157E 00
  4  3 0.1464 121.152    8.551   -5.490 138.357 -0.0607   0        0.175                                           0.6258E-01
  4  4 0.2730 138.662    8.551   -5.490 138.357 -0.0532   0        0.115                                           0.5756E-01
  4  5 0.4218 159.246    8.551   -5.490 138.357 -0.0378   0        0.108                                           0.5253E-01
  4  6 0.5782 180.890    8.551   -5.490 138.357 -0.0276   0        0.068                                           0.4751E-01
  4  7 0.7270 201.474    8.551   -5.490 138.357 -0.0257   0        0.182                                           0.7605E-01
  4  8 0.8536 218.985    8.551   -5.490 138.357 -0.0272   0        0.060                                           0.2995E-01
  4  9 0.9455 231.707    8.551   -5.490 138.357 -0.0288   0        0.126                                           0.6325E-01
  4 10 0.9938 238.395    8.551   -5.490 138.357 -0.0293   0        0.027                                           0.1342E-01

  5  1 0.0062 114.621   12.506   -5.478 125.283  0.0062   0        0.555      17.920    0.162     0.19   -0.0226   0.2794E 00   0.20355   1.92527
  5  2 0.0545 120.677   12.506   -5.478 125.283 -0.0451   0        0.277                                           0.1390E 00
  5  3 0.1464 132.197   12.506   -5.478 125.283 -0.0583   0        0.159                                           0.7974E-01
  5  4 0.2730 148.052   12.506   -5.478 125.283 -0.0508   0        0.136                                           0.6817E-01
  5  5 0.4218 166.692   12.506   -5.478 125.283 -0.0407   0        0.112                                           0.5661E-01
  5  6 0.5782 186.290   12.506   -5.478 125.283 -0.0335   0        0.090                                           0.4504E-01
  5  7 0.7270 204.929   12.506   -5.478 125.283 -0.0316   0        0.149                                           0.7431E-01
  5  8 0.8536 220.785   12.506   -5.478 125.283 -0.0317   0        0.107                                           0.5349E-01
  5  9 0.9455 232.305   12.506   -5.478 125.283 -0.0320   0        0.067                                           0.3373E-01
  5 10 0.9938 238.361   12.506   -5.478 125.283 -0.0322   0        0.143                                           0.7160E-01

  6  1 0.0062 127.900   16.461   -5.465 112.208  0.0277   0        0.651      19.288    0.183     0.16   -0.0261   0.3266E 00   0.23781   1.85533
  6  2 0.0545 132.928   16.461   -5.465 112.208 -0.0270   0        0.289                                           0.1345E 00
  6  3 0.1464 143.242   16.461   -5.465 112.208 -0.0478   0        0.206                                           0.1024E 00
  6  4 0.2730 157.442   16.461   -5.465 112.208 -0.0478   0        0.169                                           0.9458E-01
  6  5 0.4218 174.137   16.461   -5.465 112.208 -0.0438   0        0.133                                           0.6692E-01
  6  6 0.5782 191.690   16.461   -5.465 112.208 -0.0400   0        0.098                                           0.4905E-01
  6  7 0.7270 208.384   16.461   -5.465 112.208 -0.0378   0        0.128                                           0.6284E-01
  6  8 0.8536 222.580   16.461   -5.465 112.208 -0.0361   0        0.121                                           0.6068E-01
  6  9 0.9455 232.903   16.461   -5.465 112.208 -0.0352   0        0.177                                           0.8930E-01
  6 10 0.9938 238.327   16.461   -5.465 112.208 -0.0351   0        0.091                                           0.4545E-01

  7  1 0.0062 140.380   20.416   -5.453  99.134  0.0443   0        0.667      17.386    0.175     0.18   -0.0254   0.3324E 00   0.23325   1.66739
  7  2 0.0545 145.172   20.416   -5.453  99.134 -0.0082   0        0.297                                           0.1489E 00
  7  3 0.1464 154.287   20.416   -5.453  99.134 -0.0274   0        0.232                                           0.1165E 00
  7  4 0.2730 166.834   20.416   -5.453  99.134 -0.0481   0        0.192                                           0.9620E-01
  7  5 0.4218 181.582   20.416   -5.453  99.134 -0.0470   0        0.151                                           0.7594E-01
  7  6 0.5782 197.090   20.416   -5.453  99.134 -0.0461   0        0.111                                           0.5567E-01
  7  7 0.7270 211.836   20.416   -5.453  99.134 -0.0434   0        0.136                                           0.6723E-01
  7  8 0.8536 224.386   20.416   -5.453  99.134 -0.0408   0        0.157                                           0.7865E-01
  7  9 0.9455 233.501   20.416   -5.453  99.134 -0.0386   0        0.084                                           0.4229E-01
  7 10 0.9938 238.293   20.416   -5.453  99.134 -0.0380   0        0.117                                           0.5858E-01

                                   PANEL NO.    3                 WING PANEL NO.  2

  8  1 0.0062 151.897   23.952   -5.689  87.998  0.0566   0        0.700      16.960    0.188    -9.84   -0.0244   0.3513E 00   0.23583   1.67703
  8  2 0.0545 156.151   23.952   -5.689  87.998  0.0046   0        0.290                                           0.1408E 00
  8  3 0.1464 164.242   23.952   -5.689  87.998 -0.0276   0        0.270                                           0.1357E 00
  8  4 0.2730 175.374   23.952   -5.689  87.998 -0.0393   0        0.226                                           0.1132E 00
  8  5 0.4218 188.471   23.952   -5.689  87.998 -0.0447   0        0.181                                           0.9069E-01
  8  6 0.5782 202.237   23.952   -5.689  87.998 -0.0460   0        0.136                                           0.6817E-01
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1607-327-74 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  2.550    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  C  X/C       X        Y         Z      CHORD    SLOPE  ITS     DCP      CNC      CN       CL      CMT        GAMMA       CTC      CDC

  8  7 0.7270 215.324  23.952   -5.688   87.998 -0.0441  0     0.133                                       0.6685E-01
  8  8 0.8536 226.466  23.952   -5.688   87.998 -0.0412  0     0.095                                       0.4268E-01
  8  9 0.9455 234.557  23.952   -5.688   87.998 -0.0395  0     0.130                                       0.6514E-01
  8 10 0.9938 238.811  23.952   -5.688   87.998 -0.0386  0     0.112                                       0.5624E-01

  9  1 0.0062 162.050     .067  -6.173   78.799  0.0444  0     0.806   16.227   0.287    -6.84  -0.3270   0.4344E 00  0.29429  1.33561
  9  2 0.0545 165.        27.067  -6.173   78.799  0.0146  0     0.226                                       0.1136E 00
  9  3 0.1444 173.105  27.067   -6.173   78.799 -0.0198  0     0.308                                       0.1531E 00
  9  4 0.2730 183.077  27.067   -6.173   78.799 -0.0308  0     0.276                                       0.1284E 00
  9  5 0.4218 194.801  27.067   -6.173   78.799 -0.0376  0     0.208                                       0.1096E 00
  9  6 0.5782 207.128  27.067   -6.173   78.799 -0.0394  0     0.157                                       0.7879E-01
  9  7 0.7270 218.851  27.067   -6.172   78.799 -0.0397  0     0.146                                       0.7338E-01
  9  8 0.8536 228.824  27.067   -6.173   78.799 -0.0384  0     0.123                                       0.6165E-01
  9  9 0.9455 236.076  27.067   -6.173   78.799 -0.0374  0     0.091                                       0.4594E-01
  9 10 0.9938 239.879  27.067   -6.173   78.799 -0.0371  0     0.148                                       0.7405E-01

 10  1 0.0062 172.203  30.183   -6.658   69.600  0.0431  0     0.750   15.979   0.278    -6.84  -0.3284   0.3766E 00  0.26394  1.23159
 10  2 0.0545 175.569  30.183   -6.658   69.600  0.0221  0     0.367                                       0.1848E 00
 10  3 0.1444 181.966  30.183   -6.658   69.600 -0.0043  0     0.333                                       0.1671E 00
 10  4 0.2730 190.776  30.183   -6.658   69.600 -0.0216  0     0.279                                       0.1394E 00
 10  5 0.4218 201.131  30.183   -6.658   69.600 -0.0293  0     0.226                                       0.1127E 00
 10  6 0.5782 212.019  30.183   -6.658   69.600 -0.0335  0     0.170                                       0.9562E-01
 10  7 0.7270 222.374  30.183   -6.658   69.600 -0.0353  0     0.157                                       0.7871E-01
 10  8 0.8536 231.182  30.183   -6.658   69.600 -0.0356  0     0.121                                       0.6565E-01
 10  9 0.9455 237.582  30.183   -6.658   69.600 -0.0356  0     0.109                                       0.5429E-01
 10 10 0.9938 240.947  30.183   -6.658   69.600 -0.0355  0     0.091                                       0.4554E-01

                                   PANEL NO.   4                 WING PANEL NO. 3

 11  1 0.0062 180.677  33.007   -7.104   61.997  0.0336  0     0.966   15.736   0.266    -6.16  -0.0217   0.4867E 00  0.11176  1.20229
 11  2 0.0545 183.674  33.007   -7.104   61.997  0.0278  0     0.696                                       0.3483E 00
 11  3 0.1444 189.374  33.007   -7.104   61.997 -0.0042  0     0.422                                       0.2119E 00
 11  4 0.2730 197.221  33.007   -7.104   61.997 -0.0158  0     0.150                                       0.7545E-01
 11  5 0.4218 206.444  33.007   -7.104   61.997 -0.0236  0     0.177                                       0.9904E-01
 11  6 0.5782 216.143  33.007   -7.104   61.997 -0.0288  0     0.208                                       0.1029E 00
 11  7 0.7270 225.367  33.007   -7.104   61.997 -0.0312  0     0.133                                       0.6665E-01
 11  8 0.8536 233.213  33.007   -7.104   61.997 -0.0324  0     0.123                                       0.6197E-01
 11  9 0.9455 238.914  33.007   -7.104   61.997 -0.0329  0     0.133                                       0.6664E-01
 11 10 0.9938 241.911  33.007   -7.104   61.997 -0.0332  0     0.146                                       0.7291E-01

 12  1 0.0062 187.470  35.538   -7.512   55.990  0.0198  0     1.010   14.418   0.257    -6.14  -0.0203   0.5068E 00  0.18205  1.07713
 12  2 0.0545 190.176  35.538   -7.512   55.990  0.0280  0     0.734                                       0.3692E 00
 12  3 0.1444 195.325  35.538   -7.512   55.990 -0.0030  0     0.458                                       0.2297E 00
 12  4 0.2730 202.411  35.538   -7.512   55.990 -0.0131  0     0.182                                       0.9116E-01
 12  5 0.4218 210.741  35.538   -7.512   55.990 -0.0199  0     0.212                                       0.1063E 00
 12  6 0.5782 219.500  35.538   -7.512   55.990 -0.0248  0     0.183                                       0.9159E-01
 12  7 0.7270 227.830  35.538   -7.512   55.990 -0.0273  0     0.122                                       0.6132E-01
 12  8 0.8536 234.916  35.538   -7.512   55.990 -0.0287  0     0.143                                       0.7167E-01
 12  9 0.9455 240.064  35.538   -7.512   55.990 -0.0296  0     0.135                                       0.6767E-01
 12 10 0.9938 242.771  35.538   -7.512   55.990 -0.0299  0     0.144                                       0.7237E-01

                                   PANEL NO.   5                 WING PANEL NO. 4

 13  1 0.0062 194.854  39.289   -7.873   50.260  0.0083  0     1.016   13.737   0.273    -6.05  -0.0248   0.5101E 00  0.18381  1.03069
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1407-32/-24 WING) WITH C/D NACELLES. (1/10 SCALE).

MACH =  2.550    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  C  X/C       X        Y         Z      CHORD    SLOPE  ITS      DCP       CNC      CN       XL       CMT         GAMMA       CTC       CDC


 13  2 0.0545 197.284   38.289    -7.873   50.260   0.0252  0      0.699                                              0.3417E 00
 13  3 0.1464 201.903   38.289    -7.873   50.260  -0.0010  0      0.444                                              0.2407E 00
 13  4 0.2730 208.266   38.289    -7.873   50.260  -0.0084  0      0.300                                              0.1552E 00
 13  5 0.4218 215.744   38.289    -7.873   50.260  -0.0153  0      0.124                                              0.6227E-01
 13  6 0.5782 223.606   38.289    -7.873   50.260  -0.0197  0      0.197                                              0.7889E-01
 13  7 0.7270 231.084   38.289    -7.873   50.260  -0.0226  0      0.177                                              0.9883E-01
 13  8 0.8536 237.445   38.289    -7.873   50.260  -0.0234  0      0.144                                              0.7331E-01
 13  9 0.9455 242.066   38.289    -7.873   50.260  -0.0244  0      0.173                                              0.9188E-01
 13 10 0.9938 244.496   38.289    -7.873   50.260  -0.0247  0      0.167                                              0.8308E-01

 14  1 0.0062 202.831   41.259    -8.188   44.806  -0.0016  0      1.990    13.159   0.296    -8.08   -0.0969      0.5018E 00  0.29716   0.09619
 14  2 0.0545 204.997   41.259    -8.188   44.806   0.0191  0      0.895                                              0.2985E 00
 14  3 0.1464 209.117   41.259    -8.188   44.806   0.0016  0      0.466                                              0.2340E 00
 14  4 0.2730 214.787   41.259    -8.188   44.806  -0.0045  0      0.337                                              0.1691E 00
 14  5 0.4218 221.453   41.259    -8.188   44.806  -0.0094  0      0.290                                              0.1042E 00
 14  6 0.5782 228.463   41.259    -8.188   44.806  -0.0133  0      [illegible]                                        0.9737E-01
 14  7 0.7270 235.124   41.259    -8.188   44.806  -0.0152  0      0.234                                              0.1034E 00
 14  8 0.8536 240.799   41.259    -8.188   44.806  -0.0163  0      0.187                                              0.9396E-01
 14  9 0.9455 244.919   41.259    -8.188   44.806  -0.0172  0      0.197                                              0.9389E-01
 14 10 0.9938 247.085   41.259    -8.188   44.806  -0.0175  0      0.169                                              0.9168E-01

 15  1 0.0062 210.807   44.229    -8.502   39.353  -0.0163  0      1.470    12.447   0.322    -6.05   -0.0438      0.7377E 00  0.27370   0.91602
 15  2 0.0545 212.709   44.229    -8.502   39.353   0.0131  0      0.647                                              0.2401E 00
 15  3 0.1464 216.326   44.228    -8.502   39.353   0.0043  0      0.417                                              0.2081E 00
 15  4 0.2730 221.308   44.228    -8.502   39.353  -0.0007  0      0.351                                              0.1762E 00
 15  5 0.4218 227.163   44.228    -8.502   39.353  -0.0046  0      0.287                                              0.1442E 00
 15  6 0.5782 233.319   44.228    -8.502   39.353  -0.0061  0      0.226                                              0.1147E 00
 15  7 0.7270 239.174   44.228    -8.502   39.353  -0.0084  0      0.236                                              0.1197E 00
 15  8 0.8536 244.154   44.228    -8.502   39.353  -0.0092  0      0.219                                              0.1097E 00
 15  9 0.9455 247.773   44.228    -8.502   39.353  -0.0101  0      0.190                                              0.1091E 00
 15 10 0.9938 249.675   44.229    -8.502   39.353  -0.0162  0      0.176                                              0.8846E-01

 16  1 0.0062 218.763   47.198    -8.817   33.899  -0.0196  0      1.736    11.929   0.349    -6.05   -0.0433      0.9702E 00  0.31695   0.73223
 16  2 0.0545 220.422   47.198    -8.817   33.899   0.0071  0      0.657                                              0.2268E 00
 16  3 0.1464 223.534   47.198    -8.817   33.899   0.0064  0      0.439                                              0.2209E 00
 16  4 0.2730 227.829   47.198    -8.817   33.899   0.0043  0      0.427                                              0.2142E 00
 16  5 0.4218 232.873   47.198    -8.817   33.899   0.0008  0      0.416                                              0.2079E 00
 16  6 0.5782 238.176   47.198    -8.817   33.899  -0.0004  0      0.220                                              0.1106E 00
 16  7 0.7270 243.219   47.198    -8.817   33.899  -0.0016  0      0.201                                              0.1011E 00
 16  8 0.8536 247.509   47.198    -8.817   33.899  -0.0023  0      0.197                                              0.9139E-01
 16  9 0.9455 250.626   47.198    -8.817   33.899  -0.0028  0      0.190                                              0.9408E-01
 16 10 0.9938 252.265   47.198    -8.817   33.899  -0.0036  0      0.190                                              0.9543E-01

                                    PANEL NO.   6                     WING PANEL NO.  5

 17  1 0.0062 225.307   50.265    -9.077   30.000  -0.0254  0      0.690    10.910   0.364    -3.71   -0.0378      0.3461E 00  0.0       0.09477
 17  2 0.0545 226.757   50.265    -9.077   30.000   0.0014  0      1.001                                              0.5023E 00
 17  3 0.1464 229.515   50.265    -9.077   30.000   0.0070  0      0.573                                              0.2624E 00
 17  4 0.2730 233.312   50.265    -9.077   30.000   0.0056  0      0.424                                              0.2152E 00
 17  5 0.4218 237.775   50.265    -9.077   30.000   0.0046  0      0.318                                              0.1595E 00
 17  6 0.5782 242.468   50.265    -9.077   30.000   0.0049  0      0.296                                              0.1475E 00
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## TABLE A-1. - Continued

SUPERSONIC CRUISE VEHICLE (CL1607-327-74 WING) WITH O/A NACELLES. (1/10 SCALE).

MACH = 2.950 ALPHA = 5.000 DG PSI = 0.0 DG PITCH RATE = 0.0 D/S ROLL RATE = 0.0 D/S YAW RATE = 0.0 D/S

| S | C | X/C | X | Y | Z | CHORD | SLOPE | ITS | DCP | CNC | CN | DL | CMT | GAMMA | CTC | CDC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 7 | 0.7270 | 246.932 | 50.265 | -9.077 | 30.000 | 0.0044 | 0 | 0.159 | | | | | 0.7794E-01 | | |
| 17 | 8 | 0.8536 | 250.728 | 50.265 | -9.077 | 30.000 | 0.0043 | 0 | 0.179 | | | | | 0.8804E-01 | | |
| 17 | 9 | 0.9455 | 253.487 | 50.265 | -9.077 | 30.000 | 0.0040 | 0 | 0.221 | | | | | 0.1109E 00 | | |
| 17 | 10 | 0.9938 | 254.937 | 50.265 | -9.077 | 30.000 | 0.0039 | 0 | 0.219 | | | | | 0.1098E 00 | | |
| 18 | 1 | 0.0062 | 230.376 | 53.428 | -9.282 | 27.655 | -0.0277 | 0 | 0.338 | 10.266 | 0.371 | -3.71 | -0.0616 | 0.1696E 00 | 0.0 | 0.86006 |
| 18 | 2 | 0.0545 | 231.713 | 53.428 | -9.282 | 27.655 | -0.0046 | 0 | 0.320 | | | | | 0.1608E 00 | | |
| 18 | 3 | 0.1464 | 234.256 | 53.428 | -9.282 | 27.655 | 0.0042 | 0 | 0.511 | | | | | 0.2563E 00 | | |
| 18 | 4 | 0.2730 | 237.756 | 53.428 | -9.282 | 27.655 | 0.0045 | 0 | 0.657 | | | | | 0.3296E 00 | | |
| 18 | 5 | 0.4218 | 241.870 | 53.428 | -9.282 | 27.655 | 0.0064 | 0 | 0.377 | | | | | 0.1893E 00 | | |
| 18 | 6 | 0.5782 | 246.197 | 53.428 | -9.282 | 27.655 | 0.0083 | 0 | 0.331 | | | | | 0.1660E 00 | | |
| 18 | 7 | 0.7270 | 250.311 | 53.428 | -9.282 | 27.655 | 0.0098 | 0 | 0.329 | | | | | 0.1629E 00 | | |
| 18 | 8 | 0.8536 | 253.811 | 53.428 | -9.282 | 27.655 | 0.0104 | 0 | 0.199 | | | | | 0.1001E 00 | | |
| 18 | 9 | 0.9455 | 256.354 | 53.428 | -9.282 | 27.655 | 0.0106 | 0 | 0.150 | | | | | 0.7513E-01 | | |
| 18 | 10 | 0.9938 | 257.691 | 53.428 | -9.282 | 27.655 | 0.0108 | 0 | 0.136 | | | | | 0.6837E-01 | | |
| 19 | 1 | 0.0062 | 235.446 | 56.591 | -9.487 | 25.311 | -0.0300 | 0 | 0.327 | 9.422 | 0.372 | -3.71 | -0.0783 | 0.1640E 00 | 0.0 | 0.77525 |
| 19 | 2 | 0.0545 | 236.669 | 56.591 | -9.487 | 25.311 | -0.0094 | 0 | 0.286 | | | | | 0.1434E 00 | | |
| 19 | 3 | 0.1464 | 238.997 | 56.591 | -9.487 | 25.311 | 0.0014 | 0 | 0.355 | | | | | 0.1782E 00 | | |
| 19 | 4 | 0.2730 | 242.200 | 56.591 | -9.487 | 25.311 | 0.0056 | 0 | 0.476 | | | | | 0.2378E 00 | | |
| 19 | 5 | 0.4218 | 245.966 | 56.591 | -9.487 | 25.311 | 0.0083 | 0 | 0.566 | | | | | 0.2837E 00 | | |
| 19 | 6 | 0.5782 | 249.925 | 56.591 | -9.487 | 25.311 | 0.0118 | 0 | 0.401 | | | | | 0.2013E 00 | | |
| 19 | 7 | 0.7270 | 253.691 | 56.591 | -9.487 | 25.311 | 0.0153 | 0 | 0.251 | | | | | 0.1258E 00 | | |
| 19 | 8 | 0.8536 | 256.894 | 56.591 | -9.487 | 25.311 | 0.0167 | 0 | 0.273 | | | | | 0.1371E 00 | | |
| 19 | 9 | 0.9455 | 259.221 | 56.591 | -9.487 | 25.311 | 0.0171 | 0 | 0.224 | | | | | 0.1123E 00 | | |
| 19 | 10 | 0.9938 | 260.445 | 56.591 | -9.487 | 25.311 | 0.0172 | 0 | 0.294 | | | | | 0.1474E 00 | | |
| 20 | 1 | 0.0062 | 240.515 | 59.755 | -9.692 | 22.967 | -0.0323 | 0 | 0.302 | 8.167 | 0.355 | -3.71 | -0.0913 | 0.1513E 00 | 0.0 | 0.65824 |
| 20 | 2 | 0.0545 | 241.625 | 59.755 | -9.692 | 22.967 | -0.0167 | 0 | 0.280 | | | | | 0.1407E 00 | | |
| 20 | 3 | 0.1464 | 243.737 | 59.755 | -9.692 | 22.967 | -0.0014 | 0 | 0.270 | | | | | 0.1356E 00 | | |
| 20 | 4 | 0.2730 | 246.644 | 59.755 | -9.692 | 22.967 | 0.0023 | 0 | 0.369 | | | | | 0.1851E 00 | | |
| 20 | 5 | 0.4218 | 250.061 | 59.755 | -9.692 | 22.967 | 0.0101 | 0 | 0.626 | | | | | 0.3131E 00 | | |
| 20 | 6 | 0.5782 | 253.653 | 59.755 | -9.692 | 22.967 | 0.0152 | 0 | 0.303 | | | | | 0.1520E 00 | | |
| 20 | 7 | 0.7270 | 257.076 | 59.755 | -9.692 | 22.967 | 0.0208 | 0 | 0.400 | | | | | 0.2008E 00 | | |
| 20 | 8 | 0.8536 | 259.977 | 59.755 | -9.692 | 22.967 | 0.0229 | 0 | 0.234 | | | | | 0.1174E 00 | | |
| 20 | 9 | 0.9455 | 262.089 | 59.755 | -9.692 | 22.967 | 0.0236 | 0 | 0.211 | | | | | 0.1060E 00 | | |
| 20 | 10 | 0.9938 | 263.199 | 59.755 | -9.692 | 22.967 | 0.0238 | 0 | 0.222 | | | | | 0.1114E 00 | | |
| 21 | 1 | 0.0062 | 245.585 | 62.918 | -9.897 | 20.622 | -0.0346 | 0 | 0.303 | 7.219 | 0.350 | -3.71 | -0.1046 | 0.1519E 00 | 0.0 | 0.56842 |
| 21 | 2 | 0.0545 | 246.582 | 62.918 | -9.897 | 20.622 | -0.0201 | 0 | 0.268 | | | | | 0.1343E 00 | | |
| 21 | 3 | 0.1464 | 248.478 | 62.918 | -9.897 | 20.622 | -0.0042 | 0 | 0.237 | | | | | 0.1189E 00 | | |
| 21 | 4 | 0.2730 | 251.088 | 62.918 | -9.897 | 20.622 | 0.0012 | 0 | 0.259 | | | | | 0.1298E 00 | | |
| 21 | 5 | 0.4218 | 254.156 | 62.918 | -9.897 | 20.622 | 0.0114 | 0 | 0.309 | | | | | 0.1548E 00 | | |
| 21 | 6 | 0.5782 | 257.382 | 62.918 | -9.897 | 20.622 | 0.0187 | 0 | 0.433 | | | | | 0.2174E 00 | | |
| 21 | 7 | 0.7270 | 260.450 | 62.918 | -9.897 | 20.622 | 0.0263 | 0 | 0.541 | | | | | 0.2717E 00 | | |
| 21 | 8 | 0.8536 | 263.060 | 62.918 | -9.897 | 20.622 | 0.0291 | 0 | 0.336 | | | | | 0.1685E 00 | | |
| 21 | 9 | 0.9455 | 264.956 | 62.918 | -9.897 | 20.622 | 0.0301 | 0 | 0.350 | | | | | 0.1758E 00 | | |
| 21 | 10 | 0.9938 | 265.953 | 62.918 | -9.897 | 20.622 | 0.0304 | 0 | 0.311 | | | | | 0.1561E 00 | | |

PANEL NO. 7 UPPER NACELLE PYLON

| S | C | X/C | X | Y | Z | CHORD | SLOPE | ITS | DCP | CNC | CN | DL | CMT | GAMMA | CTC | CDC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 1 | 0.0062 | 209.642 | 22.394 | -4.423 | 39.300 | 0.0 | 0 | -0.020 | -0.699 | -0.018 | -90.00 | -0.0036 | -0.9957E-02 | 0.0 | -0.00000 |

## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1807-327-74 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  2.550    ALPHA =  5.000 DG    PSI =  0.0   DG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

 S  C  X/C       X        Y        Z      CHORD    SLOPE   ITS    DCP      CNC     CN      DL      CMT       GAMMA       CTC     CDC

22  2 0.0545 211.542  22.394  -4.423  39.300   0.0       0   -0.008                                       -0.4203E-02
22  3 0.1464 215.155  22.394  -4.423  39.300   0.0       0   -0.068                                       -0.3245E-01
22  4 0.2730 220.129  22.394  -4.423  39.300   0.0       0   -0.015                                       -0.7725E-02
22  5 0.4218 225.976  22.394  -4.423  39.300   0.0       0   -0.081                                       -0.4064E-01
22  6 0.5782 232.124  22.394  -4.423  39.300   0.0       0   -0.079                                       -0.1475E-01
22  7 0.7270 237.971  22.394  -4.423  39.300   0.0       0    0.045                                        0.2249E-01
22  8 0.8536 242.945  22.394  -4.423  39.300   0.0       0   -0.070                                       -0.3530E-01
22  9 0.9455 246.558  22.394  -4.423  39.300   0.0       0    0.119                                        0.5690E-01
22 10 0.9938 248.458  22.394  -4.423  39.300   0.0       0    0.131                                        0.6570E-01

                                  PANEL NO.   8                UPPER NACELLE

23  1 0.0062 209.642  23.863   2.536  39.300   0.0000    1   -0.016  -0.039 -0.002  -30.00   0.0039   0.1760E-01  0.0   -0.00392
23  2 0.0545 211.542  23.863   2.536  39.300   0.0000    1   -0.019                                        0.1926E-01
23  3 0.1464 215.155  23.863   2.536  39.300   0.0000    1   -0.021                                        0.2211E-01
23  4 0.2730 220.129  23.863   2.536  39.300   0.0000    1   -0.013                                        0.1669E-01
23  5 0.4218 225.976  23.863   2.536  39.300   0.0000    1    0.009                                       -0.2595E-02
23  6 0.5782 232.124  23.863   2.536  39.300  -0.0000    1    0.026                                       -0.1357E-01
23  7 0.7270 237.971  23.863   2.536  39.300  -0.0000    1   -0.004                                        0.7754E-02
23  8 0.8536 242.945  23.863   2.536  39.300  -0.0000    1    0.064                                       -0.7634E-02
23  9 0.9455 246.558  23.863   2.536  39.300  -0.0000    1    0.029                                       -0.2560E-01
23 10 0.9938 248.458  23.863   2.536  39.300  -0.0000    1    0.015                                       -0.1794E-01

24  1 0.0062 209.642  25.332  -0.008  39.300   0.0000    1    0.005  -0.269 -0.008  -90.00   0.0075  -0.9561E-02  0.0   -0.00000
24  2 0.0545 211.542  25.332  -0.008  39.300   0.0000    1   -0.008                                       -0.5293E-02
24  3 0.1464 215.155  25.332  -0.008  39.300   0.0000    1    0.007                                       -0.1787E-01
24  4 0.2730 220.129  25.332  -0.008  39.300   0.0000    1   -0.002                                       -0.4970E-02
24  5 0.4218 225.976  25.332  -0.008  39.300   0.0000    1   -0.002                                       -0.2859E-02
24  6 0.5782 232.124  25.332  -0.008  39.300  -0.0000    1    0.009                                       -0.1012E-01
24  7 0.7270 237.971  25.332  -0.008  39.300  -0.0000    1    0.016                                       -0.1561E-01
24  8 0.8536 242.945  25.332  -0.008  39.300  -0.0000    1    0.006                                       -0.7801E-02
24  9 0.9455 246.558  25.332  -0.008  39.300  -0.0000    1    0.006                                        0.2437E-02
24 10 0.9938 248.458  25.332  -0.008  39.300  -0.0000    1    0.027                                       -0.7874E-02

25  1 0.0062 209.642  23.863  -2.552  39.300   0.0000    1    0.025  -0.562 -0.017 -150.00   0.0613  -0.2108E-01  0.0    0.04979
25  2 0.0545 211.542  23.863  -2.552  39.300   0.0000    1    0.037                                       -0.2565E-01
25  3 0.1464 215.155  23.863  -2.552  39.300   0.0000    1    0.044                                       -0.3925E-01
25  4 0.2730 220.129  23.863  -2.552  39.300   0.0000    1    0.026                                       -0.2449E-01
25  5 0.4218 225.976  23.863  -2.552  39.300   0.0000    1    0.008                                       -0.9913E-02
25  6 0.5782 232.124  23.863  -2.552  39.300  -0.0000    1    0.014                                       -0.1422E-01
25  7 0.7270 237.971  23.863  -2.552  39.300  -0.0000    1    0.021                                       -0.1753E-01
25  8 0.8536 242.945  23.863  -2.552  39.300  -0.0000    1   -0.017                                        0.7360E-01
25  9 0.9455 246.558  23.863  -2.552  39.300  -0.0000    1    0.015                                       -0.1021E-01
25 10 0.9938 248.458  23.863  -2.552  39.300  -0.0000    1    0.026                                       -0.2005E-01

26  1 0.0062 209.642  20.925  -2.552  39.300   0.0000    1    0.019  -0.276 -0.007  150.00  -0.0002  -0.2624E-01  0.0    0.02083
26  2 0.0545 211.542  20.925  -2.552  39.300   0.0000    1    0.026                                       -0.2529E-01
26  3 0.1464 215.155  20.925  -2.552  39.300   0.0000    1    0.036                                       -0.1615E-01
26  4 0.2730 220.129  20.925  -2.552  39.300   0.0000    1    0.011                                       -0.7927E-02
26  5 0.4218 225.976  20.925  -2.552  39.300   0.0000    1    0.004                                        0.5244E-03
26  6 0.5782 232.124  20.925  -2.552  39.300  -0.0000    1   -0.007                                        0.1434E-01
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE [illegible] WING) WITH [illegible] NACELLES. (1/10 SCALE).

MACH =  2.550     ALPHA =  5.000 DG      PSI =  0.0   DG     PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

 S  C  X/C       X        Y        Z       CHORD   SLOPE  ITS    DCP      CNC     CN      DL      CMT        GAMMA       CTC       CDC


26  7 0.7270 237.471  20.925  -2.152   34.300 -0.0000  1    -0.016                                      0.2177E-01
26  8 0.8536 242.965  20.925  -2.152   34.300 -0.0000  1     0.039                                     -0.2527E-01
26  9 0.9455 246.550  20.925  -2.152   34.300 -0.0000  1    -0.010                                      0.2043E-01
26 10 0.9938 248.458  20.925  -2.152   34.300 -0.0000  1    -0.012                                      0.2407E-01

27  1 0.0062 209.442  19.456  -0.008   34.300  0.0000  1    -0.0??  -0.326 -0.008   90.00   0.0034   0.6857E-02  0.0       0.00000
27  2 0.0545 211.542  19.456  -0.008   34.300  0.0000  1     0.0??                                      0.9730E-02
27  3 0.1464 215.157  19.456  -0.008   34.300  0.0000  1     0.016                                     -0.1787E-01
27  4 0.2730 220.179  19.456  -0.008   34.300  0.0000  1     0.006                                      0.3713E-03
27  5 0.4218 225.976  19.456  -0.008   34.300  0.0000  1    -0.0??                                      0.1157E-01
27  6 0.5782 232.124  19.456  -0.008   34.300 -0.0000  1    -0.0??                                      0.7929E-02
27  7 0.7270 237.471  19.456  -0.008   34.300 -0.0000  1     0.0??                                      0.6485E-02
27  8 0.8536 242.965  19.456  -0.008   34.300 -0.0000  1     0.021                                      0.4300E-02
27  9 0.9455 246.550  19.456  -0.008   34.300 -0.0000  1     0.030                                     -0.1466E-01
27 10 0.9938 248.458  19.456  -0.008   34.300 -0.0000  1     0.010                                      0.1211E-01

28  1 0.0062 209.442  20.925   2.536   34.300  0.0000  1    -0.030   0.127  0.008   90.00   0.0035   0.2503E-01  0.0       0.01410
28  2 0.0545 211.942  20.925   2.536   34.300  0.0000  1    -0.098                                      0.2877E-01
28  3 0.1464 215.157  20.925   2.536   34.300  0.0000  1    -0.029                                      0.3194E-01
28  4 0.2730 220.179  20.925   2.536   34.300  0.0000  1    -0.009                                      0.2686E-02
28  5 0.4218 225.976  20.925   2.536   34.300  0.0000  1    -0.024                                      0.5838E-02
28  6 0.5782 232.124  20.925   2.536   34.300 -0.0000  1    -0.007                                      0.2409E-01
28  7 0.7270 237.471  20.925   2.536   34.300 -0.0000  1     0.004                                     -0.4421E-02
28  8 0.8536 242.965  20.925   2.536   34.300 -0.0000  1     0.031                                     -0.1664E-01
28  9 0.9455 246.550  20.925   2.536   34.300 -0.0000  1     0.029                                     -0.3397E-02
28 10 0.9938 248.458  20.925   2.536   34.300 -0.0000  1     0.017                                      0.9415E-02

                                       PANEL NO.   9                   LOWER NACELLE PYLON

29  1 0.0062 209.343  22.394  -6.323   34.400  0.0     0    -0.078  -0.120 -0.009  -90.00   0.0023  -0.1422E-01  0.0      -0.00000
29  2 0.0545 211.247  22.394  -6.323   34.400  0.0     0    -0.071                                     -0.1035E-01
29  3 0.1464 214.870  22.394  -6.323   34.400  0.0     0     0.004                                      0.1949E-02
29  4 0.2730 219.856  22.394  -6.323   34.400  0.0     0    -0.013                                     -0.6361E-02
29  5 0.4218 225.718  22.394  -6.323   34.400  0.0     0     0.021                                      0.1093E-01
29  6 0.5782 231.882  22.394  -6.323   34.400  0.0     0     0.007                                      0.3544E-02
29  7 0.7270 237.744  22.394  -6.323   34.400  0.0     0     0.017                                      0.6200E-02
29  8 0.8536 242.730  22.394  -6.323   34.400  0.0     0     0.044                                      0.2437E-01
29  9 0.9455 246.353  22.394  -6.323   34.400  0.0     0    -0.122                                     -0.6100E-01
29 10 0.9938 248.257  22.394  -6.323   34.400  0.0     0    -0.091                                     -0.4981E-01

                                       PANEL NO.  10                 LOWER NACELLE

30  1 0.0062 209.343  23.780  -8.000   34.400 -0.0000  1    -0.011  -0.109 -0.005  -90.00   0.0018   0.1219E-01  0.0      -0.01425
30  2 0.0545 211.247  23.780  -8.000   34.400 -0.0000  1     0.002                                      0.1472E-01
30  3 0.1464 214.870  23.780  -8.000   34.400 -0.0000  1    -0.001                                      0.2676E-01
30  4 0.2730 219.856  23.780  -8.000   34.400  0.0000  1    -0.011                                      0.1867E-01
30  5 0.4218 225.718  23.780  -8.000   34.400  0.0000  1     0.016                                     -0.7615E-02
30  6 0.5782 231.882  23.780  -8.000   34.400  0.0000  1     0.018                                      0.1279E-01
30  7 0.7270 237.744  23.780  -8.000   34.400  0.0000  1     0.011                                      0.1191E-01
30  8 0.8536 242.730  23.780  -8.000   34.400  0.0000  1     0.006                                     -0.7079E-02
30  9 0.9455 246.353  23.780  -8.000   34.400  0.0000  1    -0.010                                      0.1380E-01
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## TABLE A-1. - Continued

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SUPERSONIC CRUISE VEHICLE (CL1=07-32/-24 WING) WITH O/U NACELLES. (1/10 SCALE).

MACH =  2.960    ALPHA =  5.000 DEG    PSI =  0.0  DEG    PITCH RATE =  0.0  D/S    ROLL RATE =  0.0  D/S    YAW RATE =  0.0  D/S

  S  C  X/C        X        Y        Z      CHORD   SLOPE  ITS    DCP      CMC     CN      CL       CMT        GAMMA      CTC     CDC

 30 10 0.9938 248.257  23.760  -9.000   39.600  0.0000   1   -0.011                                       0.1159E-01

 31  1 0.0062 209.343  25.165 -10.400   39.400 -0.0000   1    0.012   -0.316 -0.008  -89.00  -0.0010  -0.5065E-02  0.0    -0.00000
 31  2 0.0545 211.247  25.165 -10.400   39.400 -0.0000   1    0.008                                      -0.6197E-02
 31  3 0.1464 214.876  25.165 -10.400   39.400 -0.0000   1    0.042                                      -0.4497E-02
 31  4 0.2730 219.856  25.165 -10.400   39.400  0.0000   1    0.016                                       0.7460E-02
 31  5 0.4218 225.718  25.165 -10.400   39.400  0.0000   1   -0.008                                       0.1806E-01
 31  6 0.5782 231.882  25.165 -10.400   39.400  0.0000   1   -0.002                                       0.1064E-01
 31  7 0.7270 237.744  25.165 -10.400   39.400  0.0000   1    0.008                                       0.1984E-01
 31  8 0.8536 242.730  25.165 -10.400   39.400  0.0000   1    0.008                                       0.1766E-01
 31  9 0.9455 246.353  25.165 -10.400   39.400  0.0000   1   -0.007                                       0.1704E-01
 31 10 0.9938 248.257  25.165 -10.400   39.400  0.0000   1   -0.016                                       0.9410E-02

 32  1 0.0062 209.343  23.780 -12.400   39.400 -0.0000   1    0.026   -0.321 -0.018 -150.00  -0.0036  -0.1077E-01  0.0     0.02447
 32  2 0.0545 211.247  23.780 -12.400   39.400 -0.0000   1    0.009                                      -0.2325E-01
 32  3 0.1464 214.876  23.780 -12.400   39.400 -0.0000   1    0.040                                      -0.2660E-01
 32  4 0.2730 219.856  23.780 -12.400   39.400  0.0000   1    0.020                                      -0.2101E-01
 32  5 0.4218 225.718  23.780 -12.400   39.400  0.0000   1   -0.019                                       0.1715E-01
 32  6 0.5782 231.882  23.780 -12.400   39.400  0.0000   1    0.007                                      -0.4464E-02
 32  7 0.7270 237.744  23.780 -12.400   39.400  0.0000   1   -0.015                                       0.4917E-02
 32  8 0.8536 242.730  23.780 -12.400   39.400  0.0000   1   -0.007                                       0.1008E-01
 32  9 0.9455 246.353  23.780 -12.400   39.400  0.0000   1   -0.008                                       0.1379E-01
 32 10 0.9938 248.257  23.780 -12.400   39.400  0.0000   1   -0.012                                       0.1273E-01

 33  1 0.0062 209.343  21.609 -12.400   39.400 -0.0000   1    0.093   -0.479 -0.012  180.00   0.0331  -0.1592E-01  0.0     0.03456
 33  2 0.0545 211.247  21.609 -12.400   39.400 -0.0000   1    0.026                                      -0.2955E-01
 33  3 0.1464 214.876  21.609 -12.400   39.400 -0.0000   1    0.004                                      -0.3602E-01
 33  4 0.2730 219.856  21.609 -12.400   39.400  0.0000   1   -0.002                                       0.1314E-01
 33  5 0.4218 225.718  21.609 -12.400   39.400  0.0000   1    0.027                                      -0.1517E-01
 33  6 0.5782 231.882  21.609 -12.400   39.400  0.0000   1    0.011                                      -0.2319E-02
 33  7 0.7270 237.744  21.609 -12.400   39.400  0.0000   1    0.067                                      -0.2682E-02
 33  8 0.8536 242.730  21.609 -12.400   39.400  0.0000   1   -0.018                                       0.6974E-02
 33  9 0.9455 246.353  21.609 -12.400   39.400  0.0000   1    0.008                                      -0.1127E-01
 33 10 0.9938 248.257  21.609 -12.400   39.400  0.0000   1    0.009                                      -0.4297E-02

 34  1 0.0062 209.343  19.623 -10.400   39.400 -0.0000   1   -0.022   -0.272 -0.016   96.00   0.0093   0.1907E-04  0.0     0.00030
 34  2 0.0545 211.247  19.623 -10.400   39.400 -0.0000   1    0.018                                      -0.5957E-03
 34  3 0.1464 214.876  19.623 -10.400   39.400 -0.0000   1    0.007                                       0.1907E-01
 34  4 0.2730 219.856  19.623 -10.400   39.400  0.0000   1    0.009                                       0.7015E-02
 34  5 0.4218 225.718  19.623 -10.400   39.400  0.0000   1    0.022                                      -0.6678E-02
 34  6 0.5782 231.882  19.623 -10.400   39.400  0.0000   1    0.029                                      -0.3972E-02
 34  7 0.7270 237.744  19.623 -10.400   39.400  0.0000   1    0.032                                      -0.1174E-01
 34  8 0.8536 242.730  19.623 -10.400   39.400  0.0000   1    0.019                                      -0.2154E-02
 34  9 0.9455 246.353  19.623 -10.400   39.400  0.0000   1    0.011                                      -0.1264E-01
 34 10 0.9938 248.257  19.623 -10.400   39.400  0.0000   1    0.018                                      -0.8677E-02

 35  1 0.0062 209.343  21.064  -8.000   39.400 -0.0000   1    0.010   -0.269 -0.007   30.30   0.0034   0.2861E-01  0.0    -0.01984
 35  2 0.0545 211.247  21.909  -8.000   39.400 -0.0000   1   -0.010                                       0.3267E-01
 35  3 0.1464 214.876  21.909  -8.000   39.400 -0.0000   1   -0.019                                       0.2615E-01
 35  4 0.2730 219.856  21.098  -8.000   39.400  0.0000   1    0.042                                       0.1586E-01
 35  5 0.4218 225.718  21.069  -8.000   39.400  0.0000   1    0.006                                       0.1264E-01
```

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```
SUPERSONIC CRUISE VEHICLE (CL1607-2.7-74 WING) WITH D/N NACELLES. (1/10 SCALE).

MACH =  2.550    ALPHA =  5.000 D     PSI =  0.0    D    PITCH RATE =  0.0  D/S     ROLL RATE =  0.0  D/S     YAW RATE =  0.0  D/S

 S  C  X/C        X        Y         Z       CHORD    SLOPE  ITS      DCP       CNC      CN       DL      CMT         GAMMA       CTC        CDC

35  6 0.5782 231.952   21.009   -8.000   34.400   0.0000   1      0.024                                          -0.1155E-01
35  7 0.7270 237.744   21.008   -8.000   34.400   0.0000   1      0.022                                          -0.1440E-01
35  8 0.8536 242.730   21.009   -8.000   34.400   0.0000   1     -0.003                                           0.8530E-02
35  9 0.9455 246.362   21.009   -8.000   34.400   0.0000   1      0.012                                          -0.3491E-02
35 10 0.9938 248.259   21.009   -8.000   34.400   0.0000   1      0.021                                          -0.9682E-02

                                  PANEL NO.  11     (          FIN PANEL NO. 1

36  1 0.0062 249.552   64.500   -4.100   18.792   0.0      0     -0.004     0.467   0.225    90.00   -0.0730  -0.4136E-02  0.0        0.00000
36  2 0.0545 250.468   64.500   -4.100   18.792   0.0      0      0.015                                           0.9039E-02
36  3 0.1464 252.193   64.500   -4.100   18.792   0.0      0      0.126                                           0.6347E-01
36  4 0.2730 254.570   64.500   -4.100   18.792   0.0      0      0.187                                           0.7877E-01
36  5 0.4218 257.365   64.500   -4.100   18.792   0.0      0      0.214                                           0.1072E 00
36  6 0.5782 260.303   64.500   -4.100   18.792   0.0      0      0.315                                           0.1556E 00
36  7 0.7270 263.097   64.500   -4.100   18.792   0.0      0      0.206                                           0.1035E 00
36  8 0.8536 265.474   64.500   -4.100   18.792   0.0      0      0.181                                           0.9441E-01
36  9 0.9455 267.201   64.500   -4.100   18.792   0.0      0      0.402                                           0.2019E 00
36 10 0.9938 268.104   64.500   -4.100   18.792   0.0      0      0.250                                           0.1756E 00

37  1 0.0062 252.438   64.500   -7.300   17.447   0.0      0     -0.001     0.550   0.146    90.00   -0.0507  -0.5214E-03  0.0        0.00000
37  2 0.0545 253.273   64.500   -7.300   17.447   0.0      0     -0.000                                          -0.1322E-03
37  3 0.1464 254.852   64.500   -7.300   17.447   0.0      0      0.044                                           0.2216E-01
37  4 0.2730 257.041   64.500   -7.300   17.447   0.0      0      0.125                                           0.6253E-01
37  5 0.4218 259.596   64.500   -7.300   17.447   0.0      0      0.173                                           0.8564E-01
37  6 0.5782 262.416   64.500   -7.300   17.447   0.0      0      0.288                                           0.1797E 00
37  7 0.7270 265.011   64.500   -7.300   17.447   0.0      0     -0.036                                          -0.1790E-01
37  8 0.8536 267.216   64.500   -7.300   17.447   0.0      0      0.227                                           0.1146E 00
37  9 0.9455 268.824   64.500   -7.300   17.447   0.0      0      0.211                                           0.1063E 00
37 10 0.9938 269.667   64.500   -7.300   17.447   0.0      0      0.222                                           0.1112E 00

38  1 0.0062 255.311   64.500   -5.500   16.112   0.0      0      0.014     1.074   0.117    90.00   -0.0399   0.1774E-02  0.0        0.00000
38  2 0.0545 256.096   64.500   -5.500   16.112   0.0      0      0.003                                           0.1349E-02
38  3 0.1464 257.572   64.500   -5.500   16.112   0.0      0      0.027                                           0.1346E-01
38  4 0.2730 259.611   64.500   -5.500   16.112   0.0      0      0.079                                           0.3947E-01
38  5 0.4218 262.006   64.500   -5.500   16.112   0.0      0      0.158                                           0.7929E-01
38  6 0.5782 264.624   64.500   -5.500   16.112   0.0      0      0.229                                           0.1152E 00
38  7 0.7270 266.926   64.500   -5.500   16.112   0.0      0      0.212                                           0.1066E 00
38  8 0.8536 268.961   64.500   -5.500   16.112   0.0      0      0.009                                           0.4476E-02
38  9 0.9455 270.447   64.500   -5.500   16.112   0.0      0      0.097                                           0.4991E-01
38 10 0.9938 271.226   64.500   -5.500   16.112   0.0      0      0.197                                           0.9406E-01

39  1 0.0062 258.180   64.500   -3.700   14.778   0.0      0      0.024     1.000   0.061    90.00   -0.0281   0.1472E-01  0.0        0.00000
39  2 0.0545 258.962   64.500   -3.700   14.778   0.0      0      0.026                                           0.1285E-01
39  3 0.1464 260.261   64.500   -3.700   14.778   0.0      0      0.024                                           0.1192E-01
39  4 0.2730 262.131   64.500   -3.700   14.778   0.0      0      0.056                                           0.2813E-01
39  5 0.4218 264.336   64.500   -3.700   14.778   0.0      0      0.145                                           0.9298E-01
39  6 0.5782 266.641   64.500   -3.700   14.778   0.0      0      0.146                                           0.7306E-01
39  7 0.7270 268.940   64.500   -3.700   14.778   0.0      0      0.101                                           0.5048E-01
39  8 0.8536 270.710   64.500   -3.700   14.778   0.0      0      0.096                                           0.4835E-01
39  9 0.9455 272.069   64.500   -3.700   14.778   0.0      0      0.065                                           0.3249E-01
39 10 0.9938 272.763   64.500   -3.700   14.778   0.0      0      0.029                                           0.1474E-01

END OF CASE
```

## RECOMMENDATIONS FOR THE EFFICIENT USE OF THE VORLAX PROGRAM

The definitions of the input and output data presented above should suffice for the running of any arbitrary configuration through the VORLAX program. But in order to achieve an efficient and accurate use of the capabilities provided by the generalized nonplanar vortex lattice method, the following recommendations should be adhered to:

- When running a new configuration for the first time, run only one flow condition point, i.e., NMACH=1 and NALPHA=1, to check out the input deck. This should be repeated for both subsonic and supersonic Mach numbers if the analysis of the given configuration will extend through both flow regimes.

- Use this relaxation solution (IS0LV=0) whenever possible. This is due to the fact that the relaxation procedure computational time varies somewhat proportionately to the second power of the total number of vortices making up the configuration, whereas the vector solution time varies as the third power. In addition, the vector solution involves an order of magnitude increase in the data transfer operations between the computer storage and core regions.

- When major panels are in tandem, and lying approximately in the same plane, the spanwise distribution of vortex elements should be identical to prevent the trailing vortex legs shed by the fore panel from running through the control points of the aft panel, in which case, pressure distributions may show spurious oscillations with possible consequent effects on aerodynamic coefficients.

- In specifying the vortex lattice density of a given configuration as a whole, or of a particular major panel, by the quantities NV0R and RNCV, three different degrees may be considered: sparse, medium, and dense. To illustrate the case, the starboard panel of an aspect ratio 3 straight-tapered wing is sparsely latticed if NV0R=10 and RNCV=5, say; if NV0R=16 and RNCV=10, then the panel may be said to have a medium density grid. A finely latticed, or dense, grid would be obtained for the values NV0R=30 and RNCV=20. In the above examples, the grid density was considered to be uniform in both the chordwise and spanwise directions. It is obvious that mixed-type lattices like dense-spanwise-sparse-chordwise are also possible. The type of lattice, when correctly specified, is a powerful tool for the program user. It allows him to achieve the lowest computational cost for a given type of required data, as follows:

  (1) Stability and control type data (accuracy is essential only in the force and moment coefficients, good definition of the aerodynamic load distribution is not required, drag coefficient accuracy not too critical): sparse lattice.

(2) Load distribution and drag type data (good definition of the aerodynamic load distribution, both spanwise and chordwise, is required, accurate drag coefficient values are needed): medium density lattice.

(3) Surface pressure distribution type data (good definition of the surface pressure distribution -- control surface theory -- is essential, such as for wing design): lattice with maximum chordwise density and with medium spanwise density.

- In addition to the lattice, or vortex grid, density, the type of vortex distribution (cosine and equal spacing) is highly significant in determining the accuracy of the results. It has been found that chordwise cosine spacing (LAX=0) is superior in accuracy to the chordwise equal spacing (LAX=1). In terms of spanwise spacing, no significant differences have been observed between cosine (LAY=0) and equal spacing (LAY=1), the cosine spacing appearing to be slightly more accurate. For the same number of vortices, there is no difference in the computational cost between cosine and equal spacing lattices.

- When the fusiform body representation is being used (PDL=360 and NPP=1), the number of sides of the polygon defining the body cross section should be kept as low as possible, e.g., the cross section of a body of resolution can be adequately represented by a hexagon. Also, when a very slender body with pointed nose is being considered, the nose (and afterbody if it is also pointed) should be arbitrarily blunted in the input definition in order to minimize the numerical difficulties caused by the crowding of the vortical singularities in the body nose region.

Figure A-7 illustrates a typical vortex lattice model of an advanced twin-engine tactical fighter. This particular lattice model, with even chordwise and spanwise spacing (LAX=1, LAY=1), is considered sparse, and quite adequate for stability and control work, both longitudinal and lateral. In this model, both the fuselage and nacelles are represented, or simulated, by flat plate elements, i.e., NPP=0. Obviously, this body simulation does not allow the computation of surface pressures, but it is adequate, and the most computationally efficient, for stability and control work as well as for load distribution and drag data.

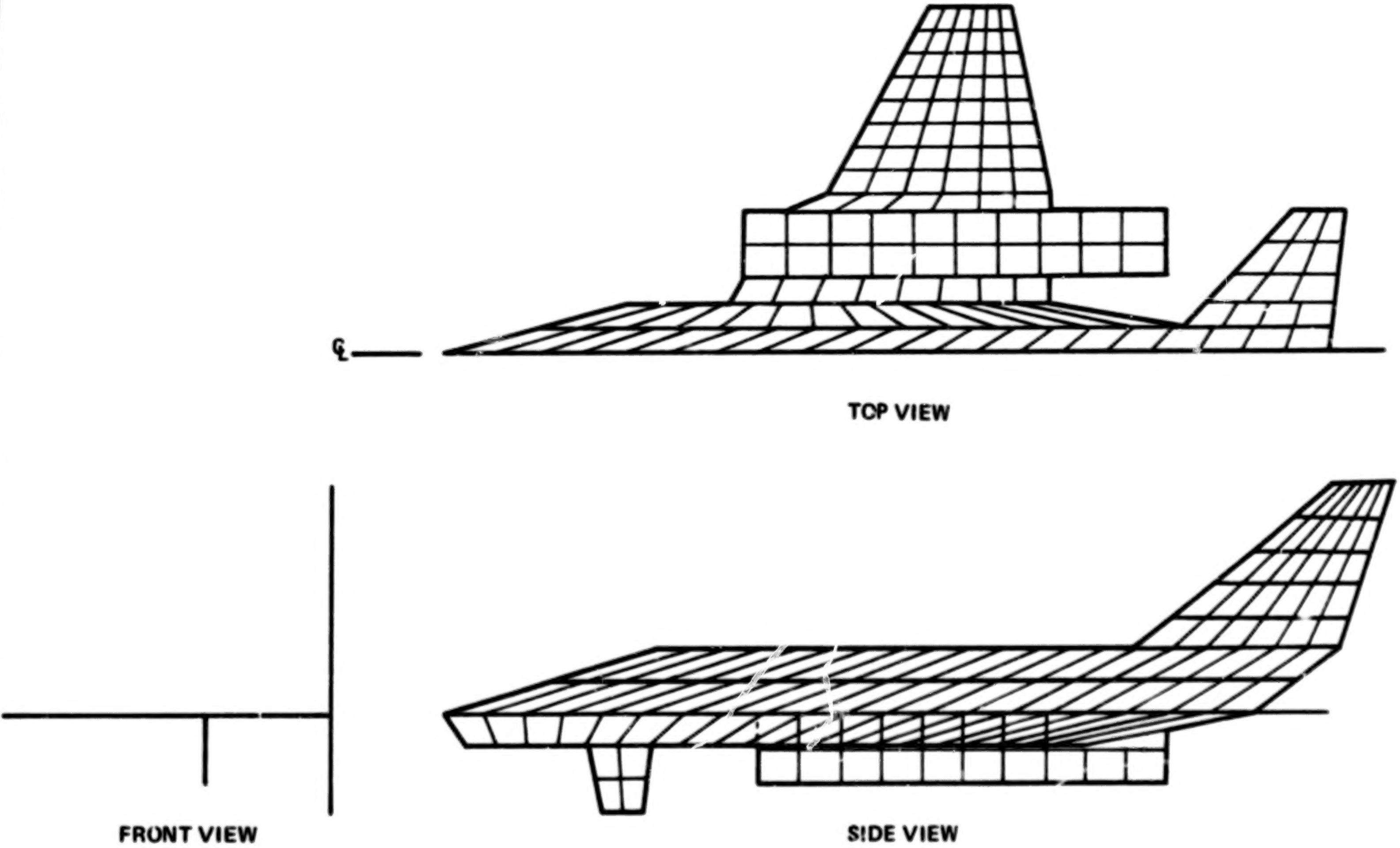
℄
TOP VIEW
FRONT VIEW
SIDE VIEW

Figure A-7. - Vortex lattice panel representation for twin engine fighter

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# APPENDIX B

# COMPLETE PROGRAM COMPILATION AND EXECUTION FOR A GENERALIZED VORTEX LATTICE METHOD FOR SUBSONIC AND SUPERSONIC FLOW APPLICATIONS

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## HARDWARE AND SYSTEMS

The VORLAX program has been run on several different IBM computer systems at Lockheed. All classified work conducted by the Advanced Development Projects Division, "Skunk Works", has been run on a 360/65 and no information can be presented about operation on this system. All non-"Skunk Works" areas such as commercial and military engineering perform aerodynamic and loads analysis using VORLAX on the IBM 360/91. Furthermore, a 370/168 has been used to assure that VORLAX can be efficiently run on this system if scientific applications are removed from the 360/91 system.

The program has been used for a wide range of aircraft configurations and a good idea of the best operational procedures has been established. The program has been run at sizes ranging from 65K words (260K bytes) to 85K words (340K bytes). An initial attempt was made to use a central memory region of 65K. This proved extremely inefficient because the number of accesses for I/O to peripheral storage soared with the imposed limitation of small buffers for each logical unit used. The program became I/O bound and larger buffers were called for. By going to large buffers, approximately 3000 words are accessed with a single read or write. With the smaller buffers, the number of words per access might be 600 - a factor of five smaller. When large cases are run on VORLAX, 5 to 10 million words may have to be accessed; it is readily apparent that the number of reads and writes can become overwhelming if the buffering is not adequate.

Almost all cases run on VORLAX use less than 20 minutes of central processor time on the 360/91. Lockheed has demonstrated that a 25 minute case will run in about 15 minutes on a Control Data Cyber 175. It is, however, incumbent on the user to ensure that the system control language is properly adjusted to optimize operation of the program and the computer on which it is running.

Since small central core size is usually an objective, it is worth noting that due consideration has been given to various methods of reducing VORLAX central memory requirements. All the obvious methods of core reduction have been found to have disadvantages. In particular, by studying the tree structure of the program, it was determined that overlay would not significantly reduce size and it would introduce inefficiences. Consequently, in order to reduce core size requirements, the actual array sizes in the program have been minimized to allow reasonable configuration complexity without unnecessary waste. But more importantly, mathematical techniques were used in the problem solution that reduce the need to have large matrices in central memory. One, two, or three elements are brought into central memory, processed, and shipped back to peripheral storage to minimize memory requirements. This results in enormous savings in central memory.

Since the Spring of 1975, the source coding has almost doubled in size with a comparable increase in program flexibility and capability and yet central memory requirements have only increased about 20 percent. This was made possible only through continued attention to the optimization of the operation of the program on Lockheed's computer complex. It is of on-going concern to continue to study possible means of improving program operational efficiency, and to this end several novel ideas are being actively examined for their possible future incorporation to the computer code.

# PROGRAM

# UNIFIED VORTEX LATTICE METHOD FOR SUBSONIC AND SUPERSONIC FLOW (VORLAX)

## COMPLETE COMPILE
## AND EXECUTION
## IN CDC FORTRAN

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```
CONTROL*VRLX.AAMAINCD                                            9/16/7 VORLAX
C********************************************************************** VORLAX
C                                                                       VORLAX
C                                                                       VORLAX
C        L       000    CCCC  K   K  H   H  EEEFF  EEEEE  DDDD          VORLAX
C        L      0   0  C      K  K   H   H  E      E      D   D         VORLAX
C        L      0   0  C      K K    H   H  E      E      D   D         VORLAX
C        L      0   0  C      KK     HHHHH  EEEFE  EEEEE  D   D         VORLAX
C        L      0   0  C      K K    H   H  E      E      D   D         VORLAX
C        L      0   0  C      K  K   H   H  E      E      D   D         VORLAX
C        LLLLL   000    CCCC  K   K  H   H  EEEFE  EEEFE  DDDDD         VORLAX
C                                                                       VORLAX
C                                                                       VORLAX
C                                                                       VORLAX
C   PPPPP RRRRR  000  PPPPP RRRRR IIIII EEEEE TTTTT  AAA  RRRRR Y   Y   VORLAX
C   P   P R   R 0   0 P   P R   R   I   E       T   A   A R   R  Y  Y   VORLAX
C   PPPPP RRRRR 0   0 PPPPP RRRRR   I   EEEEE   T   AAAAA RRRRR   Y     VORLAX
C   P     R  R  0   0 P     R  R    I   E       T   A   A R  R    Y     VORLAX
C   P     R   R 0   0 P     R   R   I   E       T   A   A R   R   Y     VORLAX
C   P     R   R  000  P     R   R IIIII EEEEE   T   A   A R   R   Y     VORLAX
C                                                                       VORLAX
C********************************************************************** VORLAX
```

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LOCKHEED PROPRIETARY DATA

```
C********************************************************************** VORLAX
C                                                                       VORLAX
C  GENERALIZED VORTEX LATTICE PROGRAM (SUBSONIC/SUPERSONIC NONPLANAR)   VORLAX
C  LUIS R. MIRANDA (DEPT. 75-41) /BLDG. 63G /(213) 847-6812/            VORLAX
C  WILLIAM M. BAKER (DEPT. 80-34) /BLDG. 67 /(213) 847-3537/            VORLAX
C  ***** LOCKHEED-CALIFORNIA COMPANY, BURBANK, CALIFORNIA *****         VORLAX
C  COMPUTER SERVICES JOB NUMBER  4565                                   VORLAX
C                                                                       VORLAX
C********************************************************************** VORLAX
C                                                                       VORLAX
C                                                                       VORLAX
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-  VORLAX
C                                                                       VORLAX
C          V       V   000  RRRRR  L           A     X   X              VORLAX
C           V     V   0   0 R   R  L          A A     X X               VORLAX
C            V   V    0   0 RRRRR  L         AAAAA     X                VORLAX
C             V V     0   0 R  R   L        A     A   X X               VORLAX
C              V       000  R   R  LLLLL   A       A X   X              VORLAX
C                                                                       VORLAX
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-  VORLAX
C                                                                       VORLAX
C                                                                       VORLAX
      PROGRAM VORLAX(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2, VORLAX
     *TAPE3,TAPE4,TAPE7,TAPE9,TAPE11,TAPE12)                            VORLAX
C...                                                                    VORLAX
C...DEFINITION OF VARIABLES STORED IN COMMON BLOCKS.                    VORLAX
C...                                                                    VORLAX
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C...B2                COMPRESSIBILITY FACTOR (M **2 - 1.)                VORLAX
C...CD, CL, CM, CN    PANEL DRAG, LIFT, PITCHING MOMENT, AND NORMAL      VORLAX
C...                  FORCE COEFFICIENTS.                                VORLAX
C...CX, CY            PANEL X- AND Y-FORCE COEFFICIENTS.                 VORLAX
C...DL                DIHEDRAL OF CHORDWISE ROW OF HORSESHOE VORTI       VORLAX
C...                  CES.                                               VORLAX
C...FN, FY            PANEL NORMAL AND Y-FORCE PER UNIT Q.               VORLAX
C...IM, IQ            ANGLE OF ATTACK AND MACH NUMBER INDICES.           VORLAX
C...NT                TOTAL NUMBER OF CHORDWISE ROWS OF VORTICES.        VORLAX
C...RM                PANEL ROLLING MOMENT PER UNIT Q.                   VORLAX
C...SX                SPANWISE LOCATION INDEX.                           VORLAX
C...XS                ABSCISSAE OF FLOW FIELD SURVEY CROSS-PLANES.       VORLAX
C...YM                PANEL YAWING MOMENT PER UNIT Q.                    VORLAX
C...YY                Y-COORDINATE OF HORSESHOE VORTEX CENTROIDS.        VORLAX
C...ZC                NORMAL CAMBER COORDINATE IN FRACTION OF CHORD.     VORLAX
C...ZZ                Z-COORDINATE OF HORSESHOE VORTEX CENTROIDS.        VORLAX
C...BIG               MAXIMUM CHANGE PER RELAXATION CYCLE.               VORLAX
C...CDC, CNC          CHORDWISE CD AND CN TIMES LOCAL CHORD.             VORLAX
C...CRM, CYM          PANEL ROLLING AND YAWING MOMENT COEFFICIENTS.      VORLAX
C...DCP               PRESSURE COEFFICIENTS (EITHER LOAD OR              VORLAX
C...                  SURFACE).                                          VORLAX
C...EPS               ACCEPTABLE FINAL RELAXATION CYCLE CHANGE.          VORLAX
C...HAG               HEIGHT ABOVE GROUND OF MOMENT REFERENCE            VORLAX
C...                  CENTER.                                            VORLAX
C...ITS, JTS          PANEL AND STRIP FLOW EXPOSURE FLAGS.               VORLAX
C...LAX,LAY           LATTICE CHORDWISE AND SPANWISE DISTRIBUTION        VORLAX
C...                  FLAGS.                                             VORLAX
C...NPP               PANEL CHORDWISE NONPLANARITY FLAG.                 VORLAX
C...NXS, NYS, NZS     NUMBER OF FLOW FIELD SURVEY PLANES (ORTHOGO        VORLAX
C...                  NAL TO THE COORDINATE AXES).                       VORLAX
C...PDL               PANEL SPANWISE NONPLANARITY FLAG. ALSO PANEL       VORLAX
C...                  PANEL DIHEDRAL IF PANEL IS FLAT IN THE SPAN        VORLAX
C...                  WISE DIRECTION.                                    VORLAX
C...PSI               YAW ANGLE (POSITIVE WHEN FLOW COMES FROM           VORLAX
C...                  PORTSIDE).                                         VORLAX
C...RCS               CROSS-SECTION RADIUS VECTOR.                       VORLAX
C...RLM               APPROXIMATE VALUE OF EIGENVALUE RADIUS OF          VORLAX
C...                  NORMALWASH MATRIX.                                 VORLAX
C...SLE               SLOPE AT LEADING EDGE.                             VORLAX
C...SPC               PANEL LEADING EDGE SUCTION FACTOR.                 VORLAX
C...TNL               TANGENT OF LEADING EDGE SWEEP.                     VORLAX
C...TNT               TANGENT OF TRAILING EDGE SWEEP.                    VORLAX
C...VSP               TANGENT OF SKEWED VORTEX LINE.                     VORLAX
C...VSS               SEMISPAN OF CHORDWISE VORTEX ROW.                  VORLAX
C...VST               ACTUAL HORSESHOE VORTEX SEMISPAN.                  VORLAX
C...XAF               CHORDWISE PERCENT COORDINATES AT WHICH CAMBER      VORLAX
C...                  IS INPUT.                                          VORLAX
C...XTE               TRAILING EDGE ABSCISSA OF VORTEX ROW.              VORLAX
C...ALFA              ANGLE OF ATTACK (IN RADIANS).                      VORLAX
C...ALOC              COMPONENT OF FREE-STREAM AND ONSET FLOWS NOR       VORLAX
C...                  MAL TO THE SURFACE AT THE CONTROL POINTS. ALSO     VORLAX
C...                  AUXILIARY ARRAY.                                   VORLAX
C...BETA              PRANDTL-GLAUERT FACTOR.                            VORLAX
C...CBAR              REFERENCE CHORD.                                   VORLAX
C...CMTC              CHORDWISE TORSIONAL MOMENT ABOUT QUARTER CHORD     VORLAX
C...                  TIMES LOCAL CHORD.                                 VORLAX
C...CSUC              PANEL LEADING EDGE THRUST PER UNIT Q.              VORLAX
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C...DRAG                PANEL INDUCED DRAG PER UNIT Q.                  VORLAX
C...HEAD                PANEL DESCRIPTION INFORMATION.                  VORLAX
C...IDES                DESIGN (SYNTHESIS) FLAG.                        VORLAX
C...IPAN                HORSESHOE STRIP PANEL INDEX.                    VORLAX
C...ITER                ACTUAL NUMBER OF RELAXATION CYCLES.             VORLAX
C...LIFT                PANEL LIFT PER UNIT Q.                          VORLAX
C...MACH                FREE-STREAM MACH NUMBER.                        VORLAX
C...NPAN                NUMBER OF PANELS DEFINED IN THE DATA INPUT.     VORLAX
C...NVOR                NUMBER OF PANEL CHORDWISE STRIPS OF VORTICES.   VORLAX
C...RNCV                CHORDWISE NUMBER OF HORSESHOE VORTICES FOR A    VORLAX
C...                    GIVEN PANEL.                                    VORLAX
C...SLE1, SLE2          SURFACE SLOPES AT LEADING EDGE OF PANEL SIDE    VORLAX
C...                    EDGES.                                          VORLAX
C...SMAX                NT.                                             VORLAX
C...SREF                CONFIGURATION REFERENCE AREA.                   VORLAX
C...SURF                PANEL SURFACE AREA (PLANFORM AREA).             VORLAX
C...VINF                REFERENCE FREE STREAM VELOCITY.                 VORLAX
C...XBAR                ABSCISSA OF MOMENT REFERENCE CENTER.            VORLAX
C...XSUC                PANEL LEADING EDGE THRUST PER UNIT Q.           VORLAX
C...YAWQ                YAW RATE (DEGS/SEC).                            VORLAX
C...YNOT                BUTTLINE ORIGIN OF FLOW FIELD SURVEY GRID.      VORLAX
C...ZBAR                ORDINATE OF MOMENT REFERENCE CENTER.            VORLAX
C...ZETA                INCIDENCE OF STREAMWISE VORTEX ROW (STRIP)      VORLAX
C...                    CHORDLINE.                                      VORLAX
C...ZLE1, ZLE2          LEADING EDGE OFFSET OF CAMBERLINE AT THE        VORLAX
C...                    PANEL SIDE EDGES.                               VORLAX
C...ZNOT                WATERLINE ORIGIN OF FLOW FIELD SURVEY GRID.     VORLAX
C...AINC1, AINC2        CHORDLINE INCIDENCE AT SIDE EDGES OF PANEL.     VORLAX
C...ALPHA               ANGLE OF ATTACK (DEGS).                         VORLAX
C...CDTOT               TOTAL INDUCED DRAG COEFFICIENT.                 VORLAX
C...CHORD               CHORD LENGTH MEASURED ALONG CENTRLINE OF        VORLAX
C...                    STREAMWISE ROW OF HORSESHOE VORTICES.           VORLAX
C...CLTOT               TOTAL LIFT COEFFICIENT.                         VORLAX
C...CMTOT               TOTAL PITCHING MOMENT COEFFICIENT.              VORLAX
C...CNTOT               TOTAL YAWING MOMENT COEFFICIENT.                VORLAX
C...CRTOT               TOTAL ROLLING MOMENT COEFFICIENT.               VORLAX
C...CYTOT               TOTAL SIDE FORCE COEFFICIENT.                   VORLAX
C...DNDX1, DNDX2        SURFACE SLOPES AT THE CONTROL POINTS MEASURED   VORLAX
C...                    ALONG THE PANEL SIDE EDGES. IF DESIGN IS IN     VORLAX
C...                    VOKED, THEY ARE THE LOAD COEFFICIENTS AT THE    VORLAX
C...                    LOAD POINTS ALONG THE PANEL SIDE EDGES.         VORLAX
C...GAMMA               HORSESHOE VORTEX CIRCULATION . ALSO USED        VORLAX
C...                    AS TEMPORARY DATA STORAGE.                      VORLAX
C...ISOLV               FLAG DETERMINING SYSTEM OF SOLUTION FOR THE     VORLAX
C...                    BOUNDARY CONDITION EQUATIONS.                   VORLAX
C...LESWP               PANEL LEADING EDGE SWEEP (DEGS).                VORLAX
C...NMACH               NUMBER OF MACH NUMBERS PER CASE.                VORLAX
C...ONSET               ONSET FLOW VELOCITIES GENERATED BY THE          VORLAX
C...                    ROTATION OF THE CONFIGURATION ABOUT THE         VORLAX
C...                    MOMENT REFERENCE CENTER.                        VORLAX
C...PSPAN               PANEL SPAN.                                     VORLAX
C...RFLAG               COEFFICIENT MULTIPLIER IN SYSTEM OF BOUNDARY    VORLAX
C...                    CONDITION EQUATIONS.                            VORLAX
C...RNMAX               NUMBER OF VORTICES FOR A GIVEN CHORDWISE ROW.   VORLAX
C...ROLLQ               ROLL RATE (DEGS/SEC).                           VORLAX
C...SLOPE               SURFACE SLOPE AT THE LATTICE CONTROL POINTS.    VORLAX
C...SYNTH               PANEL SYNTHESIS (DESIGN) FLAG.                  VORLAX
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C...TAPER               PANEL TAPER RATIO.                              VORLAX
C...TITLE               CASE TITLE.                                     VORLAX
C...WSPAN               CONFIGURATION REFERENCE WING SPAN.              VORLAX
C...XAPEX, YAPEX, ZAPEX COORDINATES OF PANEL FIRST SIDE EDGE LEADING    VORLAX
C...                    EDGE (PANEL APEX).                              VORLAX
C...CSTART              CHORD LENGTH OF PANEL FIRST SIDE EDGE.          VORLAX
C...DELTAY, DELTAZ      BUTTLINE AND WATERLINE SPACING OF FLOW FIELD    VORLAX
C...                    SURVEY GRID.                                    VORLAX
C...FLOATX, FLOATY      VORTEX WAKE FLOATATION PARAMETERS.              VORLAX
C...INTRAC              PANEL LATERAL NONPLANARITY PARAMETER.           VORLAX
C...INVERS              DESIGN (SYNTHESIS) FLAG.                        VORLAX
C...IQUANT              PANEL SYMMETRY FLAG.                            VORLAX
C...ITRMAX              MAXIMUM ALLOWABLE NUMBER OF RELAXATION CYCLES.  VORLAX
C...LATRAL              CONFIGURATION OR FLIGHT CONDITION SYMMETRY      VORLAX
C...                    FLAG.                                           VORLAX
C...MOMENT              PANEL PITCHING MOMENT PER UNIT Q.               VORLAX
C...NALPHA              NUMBER OF ANGLES OF ATTACK PER CASE.            VORLAX
C...NPANAS              TOTAL NUMBER OF PANELS THAT HAVE TO BE TAKEN    VORLAX
C...                    INTO ACCOUNT IN THE ACTUAL COMPUTATION          VORLAX
C...                    PROCESS.                                        VORLAX
C...PHIMED              ANGULAR COORDINATE OF CROSS-SECTION RADIUS      VORLAX
C...                    VECTOR.                                         VORLAX
C...PITCHQ              PITCH RATE (DEGS/SEC).                          VORLAX
C...                                                                    VORLAX
C.......................(PER UNIT Q( MEANS (PER UNIT FREE-STREAM        VORLAX
C.......................DYNAMIC PRESSURE(.                              VORLAX
C...                                                                    VORLAX
C                                                                       VORLAX
C                                                                       VORLAX
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CONTROL*VRLX.AERO                                                      VORLAX    307
C...                                                                   VORLAX    308
      SUBROUTINE AERO (EW, ITOTAL)                                     VORLAX    309
C...                                                                   VORLAX    310
C...PURPOSE     TO COMPUTE FORCE AND MOMENT DATA BY INTEGRATION OF     VORLAX    311
C...            PRESSURE DISTRIBUTION DATA AND BY TAKING INTO ACCOUNT  VORLAX    312
C...            EDGE SUCTION FORCES.                                   VORLAX    313
C...                                                                   VORLAX    314
C...INPUT       CALLING SEQUENCE≤                                      VORLAX    315
C...            EW = NORMALWASH AT LEADING EDGE INFLUENCE COEFFICIENT  VORLAX    316
C...                 MATRIX (RETRIEVED ROW BY ROW FROM UNIT 9).        VORLAX    317
C...            COMMON≤                                                VORLAX    318
C...            X, Y, Z, R2, DL, SX, YY, ZZ, DCP, JTS, LAX, PSI,       VORLAX    319
C...            SPC, VSS, VST, XTE, ALFA, MACH, NPAN, NVOR, SREF,      VORLAX    320
C...            VINF, XBAR, YAWQ, ZBAR, ZETA, CHORD, GAMMA, LESWP,     VORLAX    321
C...            PSPAN,, RNMAX, ROLLQ, SLOPE, TAPER, CSTART, IQUANT,    VORLAX    322
C...            LATRAL, NPANAS, PITCHQ.                                VORLAX    323
C...                                                                   VORLAX    324
C...OUTPUT      CALLING SEQUENCE≤                                      VORLAX    325
C...            NONE.                                                  VORLAX    326
C...            COMMON≤                                                VORLAX    327
C...            CD, CL, CM, CN, CX, CY, FN, FY, RM, YM, CDC, CNC,      VORLAX    328
C...            CRM, CYM, CMTC, CSUC, DRAG, LIFT, SURF, XSUC,          VORLAX    329
C...            CDTOT, CLTOT, CMTOT, CNTOT, CRTOT, CYTOT, MOMENT.      VORLAX    330
C...                                                                   VORLAX    331
C...SUBROUTINES                                                        VORLAX    332
C...CALLED      NONE.                                                  VORLAX    333
C...                                                                   VORLAX    334
C...DISCUSSION SUBROUTINE AERO COMPUTES THE AERODYNAMIC FORCE AND      VORLAX    335
C...            MOMENT COEFFICIENTS BY INTEGRATING THE PRESSURE        VORLAX    336
C...            DISTRIBUTION AND COMPUTING THE LEADING EDGE SUCTION    VORLAX    337
C...            FORCES IN ACCORDANCE WITH LANS PROCEDURE. THERE ARE    VORLAX    338
C...            THREE CLASSES OF COEFFICIENTS, AS FOLLOWS ≤ (1) TOTAL  VORLAX    339
C...            CONFIGURATION COEFFICIENTS, (2) PANEL COEFFICIENTS,    VORLAX    340
C...            AND (3) STRIPWISE, OR CHORDWISE, COEFFICIENTS. ALL     VORLAX    341
C...            TOTAL COEFFICIENTS ARE REFERENCED TO WIND AXES. CLASS  VORLAX    342
C...            (2) AND (3) COEFFICIENTS ARE REFERENCED EITHER TO BODY VORLAX    343
C...            OR TO WIND AXES AS REQUIRED BY THE CORRESPONDING COEFF. VORLAX   344
C...            DEFINITION. AERO SUBROUTINE IS CALLED BY MAIN FOR EVERY VORLAX   345
C...            ANGLE OF ATTACK AND MACH NUMBER COMBINATION.           VORLAX    346
C                                                                      VORLAX    347
C                                                                      VORLAX    348
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CONTROL*VRLX.BOUNDY                                              9/17/76  VORLAX     747
C...                                                                      VORLAX     748
      SUBROUTINE BOUNDY (ITOTAL)                                          VORLAX     749
C...                                                                      VORLAX     750
C...PURPOSE    TO CALCULATE THE ONSET FLOW COMPONENT NORMAL TO            VORLAX     751
C...           THE BOUNDARY SURFACE AT THE VORTEX LATTICE CON             VORLAX     752
C...           TROL POINTS.                                               VORLAX     753
C...                                                                      VORLAX     754
C...INPUT      CALLING SEQUENCE <                                         VORLAX     755
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.               VORLAX     756
C...           COMMON <                                                   VORLAX     757
C...           ALFA, PSI, VINF, PITCHQ, ROLLQ, YAWQ, LAX, RNMAX,          VORLAX     758
C...           SX, CX, X, YY, ZZ, DL, CHORD, XBAR, ZBAR, SLOPE,           VORLAX     759
C...           RFLAG.                                                     VORLAX     760
C...                                                                      VORLAX     761
C...OUTPUT     COMMON <                                                   VORLAX     762
C...           ALOC, ONSET.                                               VORLAX     763
C...                                                                      VORLAX     764
C...SUBROUTINES                                                           VORLAX     765
C...CALLED     NONE.                                                      VORLAX     766
C...                                                                      VORLAX     767
C...DISCUSSION THE ONSET FLOW COMPONENT NORMAL TO THE BOUNDARY            VORLAX     768
C...           AT THE VORTEX LATTICE CONTROL POINTS IS CALCULATED         VORLAX     769
C...           BY PROJECTING THE FREE-STREAM VELOCITY VECTOR              VORLAX     770
C...           ALONG THE SURFACE NORMAL AND TAKING INTO ACCOUNT           VORLAX     771
C...           A RIGID BODY ROTATION ABOUT THE POINT (XBAR, 0,            VORLAX     772
C...           ZBAR). THE ONSET FLOW NORMAL COMPONENT IS ALOC.            VORLAX     773
C...           ONSET DENOTES THE RIGID BODY ROTATION INDUCED              VORLAX     774
C...           VELOCITY COMPONENT ALONG THE X-AXIS. BOTH ARRAY            VORLAX     775
C...           ALOC AND ONSET, ARE DIMENSIONLESS, I.E., THEY ARE          VORLAX     776
C...           REFERENCED TO THE FREE-STREAM VELOCITY.                    VORLAX     777
C...                                                                      VORLAX     778
C...                                                                      VORLAX     779
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CONTROL*VRLX.GAUSS                                          9/13/76  VORLAX     856
C...                                                                 VORLAX     857
      SUBROUTINE GAUSS (ITOTAL, REXPAR, EW, XRT)                     VORLAX     858
C...                                                                 VORLAX     859
C...PURPOSE     TO SOLVE THE BOUNDARY CONDITION EQUATIONS BY THE     VORLAX     860
C...            METHOD OF (CONTOLLED SUCCESSIVE OVER-RELAXATION).    VORLAX     861
C...                                                                 VORLAX     862
C...INPUT       CALLING SEQUENCE<                                    VORLAX     863
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.         VORLAX     864
C...            REXPAR = RELAXATION PARAMETER.                       VORLAX     865
C...            EW = ROW OF NORMALWASH MATRIX.                       VORLAX     866
C...            COMMON<                                              VORLAX     867
C...            CX, SX, LAX, ALOC, IDES, CHORD, RNMAX, INVERS,       VORLAX     868
C...            ITRMAX.                                              VORLAX     869
C...                                                                 VORLAX     870
C...OUTPUT      CALLING SEQUENCE<                                    VORLAX     871
C...            XRT = AUXILIARY VECTOR USED IN C.S.O.R. SOLUTION.    VORLAX     872
C...            COMMON<                                              VORLAX     873
C...            BIG, DCP, EPS, RLM, SLE, ITER, GAMMA, SLOPE.         VORLAX     874
C...            GAMMA IS THE SOLUTION VECTOR OF BOUNDARY CONDITION   VORLAX     875
C...            EQUATIONS, I. E., HORSESHOE VORTEX CIRCULATION       VORLAX     876
C...            STRENGTHS.                                           VORLAX     877
C...            NOTES IF INVERS = 1 (DESIGN PROCESS) THEN GAMMA IS   VORLAX     878
C...            PART INPUT AND PART OUTPUT.                          VORLAX     879
C...                                                                 VORLAX     880
C...SUBROUTINES                                                      VORLAX     881
C...CALLED      NONE.                                                VORLAX     882
C...                                                                 VORLAX     883
C...DISCUSSION THIS SUBROUTINE SOLVES FOR THE CIRCULATION STRENGTH   VORLAX     884
C...            OF THE HORSESHOE VORTICES THAT SATISFY THE B.C. OF   VORLAX     885
C...            NO MASS-FLUX ALONG THE NORMAL TO THE SURFACE AT THE  VORLAX     886
C...            CONTROL POINTS. THIS SOLUTION IS PERFORMED ITERA     VORLAX     887
C...            TIVELY ROW BY ROW BY USING THE C.S.O.R. METHOD. IF   VORLAX     888
C...            A GIVEN ROW IS PART OF A PANEL TO BE DESIGNED, I.E., VORLAX     889
C...            IDES = 1, THEN INSTEAD OF SOLVING FOR GAMMA(= XRT),  VORLAX     890
C...            THE COMPUTATION OF THE SLOPE DISTRIBUTION ALONG      VORLAX     891
C...            THAT ROW IS PERFORMED BY MATRIX MULTIPLICATION,      VORLAX     892
C...            SLOPE = EW *GAMMA.                                   VORLAX     893
C...                                                                 VORLAX     894
C...                                                                 VORLAX     895
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CONTROL*VRLX.GEOM                                                 9/16/76
C...
      SUBROUTINE GEOM (ITOTAL)
C...
C...PURPOSE    TO COMPUTE THE VORTEX LATTICE GEOMETRY AND SURFACE
C...           SLOPES AT THE CONTROL POINTS. ALSO TO COMPUTE THE
C...           LOAD DISTRIBUTION AT THE CORRESPONDING LOAD POINTS
C...           IF DESIGN PROCESS IS INVOKED (IDES = 1).
C...
C...INPUT      CALLING SEQUENCE:
C...           NONE.
C...           COMMON:
C...           DL, ITS, LAX, LAY, NPP, PDL, RCS, VSS, NPAN, NVOR,
C...           RNCV, SLE1, SLE2, ZLE1, ZLE2, AINC1, AINC2, DNDX1,
C...           DNDX2, GAMMA, LESWP, PSPAN, SYNTH, TAPER, XAPEX,
C...           YAPEX, ZAPEX, CSTART, INTRAC, IQUANT, LATRAL,
C...           PHIMED.
C...
C...OUTPUT     CALLING SEQUENCE:
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C...           COMMON:
C...           X, Y, Z, CX, DL, NT, SX, YY, ZZ, DCP, JTS, SLE,
C...           TNL, TNT, VSP, VSS, VST, XTE, ALOC, IPAN, SMAX,
C...           ZETA, CHORD, RNMAX, SLOPE, NPANAS.
C...           NOTE: DL AND VSS MAY BE EITHER INPUT OR OUTPUT
C...           DEPENDING ON CONFIGURATION CONDITIONS.
C...
C...SUBROUTINES
C...CALLED     NONE.
C...
C...DISCUSSION THE VORTEX LATTICE GEOMETRY IS LAID OUT PANEL BY
C...           PANEL BASED ON THE GEOMETRIC AND VORTEX DISTRIBU
C...           TION CHARACTERISTICS SPECIFIED FOR THE GIVEN PANEL
C...           IN THE INPUT DATA (INPUT SUBROUTINE). EACH PANEL
C...           IS SUBDIVIDED INTO A NUMBER OF X-AXIALWISE STRIPS
C...           (NVOR). EACH STRIP CONTAINING A GIVEN NUMBER (RNMAX =
C...           RNCV) OF HORSESHOE VORTICES WHOSE BOUND TRAILING LEGS
C...           COINCIDE WITH THE X-AXIALWISE EDGES OF THE STRIP IF
C...           THE PARAMETER NPP = 0. WHEN NPP = 1 THERE IS NO
C...           LONGER A CONTINUOUS STRIP OF VORTICES SINCE THEY ARE
C...           NOT LOCATED IN THE SAME PLANE, IN THIS CASE (NPP =
C...           1) THE STRIP BECOMES AN ARRAY OR ROW OF VORTICES
C...           LOCATED IN TANDEM BUT WHOSE SPANS ARE NOT NECES
C...           SARILY EQUAL. EACH STRIP OR VORTEX ROW IS IDENTI
C...           FIED BY AN INDEX (SX). EACH HORSESHOE VORTEX IN A
C...           GIVEN STRIP OR ROW IS IDENTIFIED BY A SECOND INDEX
C...           (CX), THE VALUE CX = 1 DENOTING THE LEADING EDGE
C...           ELEMENT, AND CX = RNMAX = RNCV DENOTING THE LAST,
C...           OR TRAILING EDGE, HORSESHOE OF THE ROW. THEREFORE
C...           EACH AND EVERY HORSESHOE VORTEX IS UNIQUELY IDEN
C...           TIFIED BY EITHER AN OVERALL INDEX (WHICH RUNS FROM
C...           1 TO ITOTAL) OR BY THE PAIR OF VALUES (CX, SX).
C...           THE SPATIAL LAY-OUT OF THE VORTEX LATTICE CORRES
C...           PONDING TO A GIVEN PANEL DEPENDS ON THE VALUES OF
C...           TWO PARAMETERS: PDL AND NPP. IF PDL .LE. 360.0 THEN
C...           THE TRANSVERSE VORTEX SEGMENTS OF THE SAME VALUE OF
C...           CX FORM A CONTINUOUS STRAIGHT LINE, BUT IF PDL .GT.
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C...                360.0 THEN THE TRANSVERSE VORTEX SEGMENTS OF SAME CX.       VORLAX    1134
C...                THOUGH STILL CONTINUOUS, FORM A POLYGONAL LINE              VORLAX    1135
C...                WHEN PROJECTED ON A PLANE NORMAL TO THE X-AXIS. IF          VORLAX    1136
C...                NPP = 0 THEN ALL THE TRANSVERSE VORTEX SEGMENTS             VORLAX    1137
C...                OF A GIVEN ROW (SAME SX) LIE IN THE SAME PLANE.             VORLAX    1138
C...                BUT IF NPP = 1 THEN THE TRANSVERSE SEGMENTS OF A            VORLAX    1139
C...                ROW ARE LAID ON THE ACTUAL BODY SURFACE. THE BOUND          VORLAX    1140
C...                TRAILING LEGS OR SEGMENTS ARE ALWAYS PARALLEL TO            VORLAX    1141
C...                THE X-AXIS (UP TO THE TRAILING EDGE OF THE GIVEN            VORLAX    1142
C...                STRIP OR ROW).                                              VORLAX    1143
C...                                                                            VORLAX    1144
C...                                                                            VORLAX    1145
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CONTROL*VRLX.MAP                                                     9/14/76  VORLAX    1971
C...                                                                          VORLAX    1972
      SUBROUTINE MAP (EW, EWX, EWY, ITOTAL)                                   VORLAX    1973
C...                                                                          VORLAX    1974
C...PURPOSE     TO COMPUTE THE FLOW FIELD ABOUT THE CONFIGURATION.            VORLAX    1975
C...                                                                          VORLAX    1976
C...INPUT       CALLING SEQUENCES                                             VORLAX    1977
C...            EW = UPWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED           VORLAX    1978
C...                 ROW BY ROW FROM UNIT 3).                                 VORLAX    1979
C...            EWX = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED       VORLAX    1980
C...                  ROW BY ROW FROM UNIT 4).                                VORLAX    1981
C...            EWY = SIDEWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED        VORLAX    1982
C...                  ROW BY ROW FROM UNIT 7).                                VORLAX    1983
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.                  VORLAX    1984
C...            COMMONS                                                       VORLAX    1985
C...            IH, IQ, NT, XS, NXS, NYS, NZS, PSI, ALFA, MACH, YNOT,         VORLAX    1986
C...            ZNOT, ALPHA, GAMMA, RNMAX, DELTAY, DELTAZ.                    VORLAX    1987
C...                                                                          VORLAX    1988
C...OUTPUT      CALLING SEQUENCES                                             VORLAX    1989
C...            NONE.                                                         VORLAX    1990
C...            COMMONS                                                       VORLAX    1991
C...            NONE.                                                         VORLAX    1992
C...            DIRECT PRINTS                                                 VORLAX    1993
C...            XS, YKI, ZKI = FIELD GRID POINT COORDINATES (BODY AXIS        VORLAX    1994
C...                           SYSTEM).                                       VORLAX    1995
C...            VX, VF, WF = TOTAL DIMENSIONLESS (REFERENCED TO VELO          VORLAX    1996
C...                         CITY AT UPSTREAM INFINITY) VELOCITY COMPO-       VORLAX    1997
C...                         NENTS ALONG THE X-Y-Z AXES RESPECTIVELY          VORLAX    1998
C...                         (BODY AXIS SYSTEM).                              VORLAX    1999
C...            EPSLON = UPWASH FLOW ANGLE IN DEGREES.                        VORLAX    2000
C...            SIGMA = SIDEWASH FLOW ANGLE IN DEGREES.                       VORLAX    2001
C...            CP = LOCAL PRESSURE COEFFICIENT.                              VORLAX    2002
C...            RM = LOCAL MACH NUMBER.                                       VORLAX    2003
C...            PPTOT = (LOCAL STATIC PRESSURE)/(TOTAL PRESSURE).             VORLAX    2004
C...            PIF = (LOCAL STATIC PRESSURE)/(FREE STREAM STATIC PRES        VORLAX    2005
C...                  SURE).                                                  VORLAX    2006
C...                                                                          VORLAX    2007
C...SUBROUTINES                                                               VORLAX    2008
C...CALLED      NONE.                                                         VORLAX    2009
C...                                                                          VORLAX    2010
C...DISCUSSION FLOW FIELD QUANTITIES ARE COMPUTED AT THE NODAL POINTS         VORLAX    2011
C...            OF A 3-D GRID DEFINED AROUND THE CONFIGURATION BY A SET       VORLAX    2012
C...            OF ORTHOGONAL PLANES ( X = CONST., Y = CONST., AND            VORLAX    2013
C...            Z = CONST. PLANES). THE VELOCITIES ARE CALCULATED BY          VORLAX    2014
C...            THE USE OF INFLUENCE COEFFICIENT MATRICES BASED ON THE        VORLAX    2015
C...            VORTEX LATTICE REPRESENTATION OF THE CONFIGURATION.           VORLAX    2016
C...            THESE MATRICES ARE COMPUTED IN SUBROUTINE SURVEY AND          VORLAX    2017
C...            STORED IN UNITS 3, 4, AND 7 (ONE MATRIX AND ONE UNIT          VORLAX    2018
C...            PER VELOCITY COMPONET). THE PRESSURE RATIOS AND RELATED       VORLAX    2019
C...            FLOW QUANTITIES ARE COMPUTED THROUGH THE USE OF ISEN          VORLAX    2020
C...            TROPIC FLOW RELATIONSHIPS.                                    VORLAX    2021
C                                                                             VORLAX    2022
C                                                                             VORLAX    2023
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CONTROL*VRLX.MATRX                                               9/16/76  VORLAX   2147
C...                                                                      VORLAX   2148
      SUBROUTINE MATRX (EW, EU, ITOTAL)                                   VORLAX   2149
C....                                                                     VORLAX   2150
C...PURPOSE     TO GENERATE THREE AERODYNAMIC INFLUENCE COEFF. MATRI      VORLAX   2151
C...            CESS (1) THE NORMALWASH AT THE CONTROL POINTS             VORLAX   2152
C...            (EW / UNIT 1), (2) THE AXIALWASH AT THE CONTROL POINTS    VORLAX   2153
C...            (EU / UNIT 2), AND (3) THE NORMALWASH AT THE LEAD. EDGE   VORLAX   2154
C...            (EW / UNIT 9). THESE MATRICES REPRESENT THE INDUCED       VORLAX   2155
C...            VELOCITY FIELD DUE TO THE HORSESHOE VORTICES OF THE       VORLAX   2156
C...            LATTICE.                                                  VORLAX   2157
C...                                                                      VORLAX   2158
C...INPUT       CALLING SEQUENCES                                         VORLAX   2159
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.              VORLAX   2160
C...            COMMONS                                                   VORLAX   2161
C...            X, B2, CX, DL, NT, SX, YY, ZZ, MAG, LAX, NPP, PSI, TNT,   VORLAX   2162
C...            VSP, VST, XTE, ALFA, IPAN, XBAR, ZBAR, CHORD, RFLAG,      VORLAX   2163
C...            RNMAX, SLOPE, FLOATX, FLOATY, INVERS, LATRAL.             VORLAX   2164
C...                                                                      VORLAX   2165
C...OUTPUT      CALLING SEQUENCES                                         VORLAX   2166
C...            EW = CONTROL POINT NORMALWASH MATRIX (STORED ROW BY       VORLAX   2167
C...                 ROW IN UNIT 1).                                      VORLAX   2168
C...            EW = LEADING EDGE NORMALWASH MATRIX (STORED ROW BY        VORLAX   2169
C...                 ROW IN UNIT 9).                                      VORLAX   2170
C...            EU = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 2).      VORLAX   2171
C...            COMMONS                                                   VORLAX   2172
C...            NONE.                                                     VORLAX   2173
C...                                                                      VORLAX   2174
C...SUBROUTINES                                                           VORLAX   2175
C...CALLED      WASH, UXVEL.                                              VORLAX   2176
C...                                                                      VORLAX   2177
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES         VORLAX   2178
C...            ARE GENERATED BY COMPUTING THE CORRESPONDING VELOCITY     VORLAX   2179
C...            INDUCED AT THE (K1,J1) CONTROL POINT BY THE (K,J)         VORLAX   2180
C...            HORSESHOE VORTEX OF UNIT STRENGTH. IF K = K1 AND          VORLAX   2181
C...            J = J1 (SELF-INFLUENCE) THEN THE PRINCIPAL PART OF        VORLAX   2182
C...            THE DOWNWASH INTEGRAL IS ADDED TO THE COMPUTATION OF      VORLAX   2183
C...            THE CORRESPONDING EW COEFFICIENT. ALSO IF THE CONTROL     VORLAX   2184
C...            POINT IS WITHIN A GIVEN NEAR FIELD RADIUS OF THE          VORLAX   2185
C...            INDUCING HORSESHOE VORTEX, THE AXIALWASH CONTRIBUTION     VORLAX   2186
C...            IS COMPUTED BY INTERDIGITATED VORTEX SPLITTING.           VORLAX   2187
C...                                                                      VORLAX   2188
C...                                                                      VORLAX   2189
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CONTROL*VRLX.INPUT                                               9/16/76  VORLAX    1416
C...                                                                      VORLAX    1417
      SUBROUTINE INPUT                                                    VORLAX    1418
C...                                                                      VORLAX    1419
C...PURPOSE     TO READ IN INPUT DATA AND PREPARE SUCH DATA FOR           VORLAX    1420
C...            USE IN THE GENERATION OF VORTEX LATTICE GEOMETRY          VORLAX    1421
C...            TO BE DONE IN SUBROUTINE GEOM.                            VORLAX    1422
C...                                                                      VORLAX    1423
C...INPUT       CALLING SEQUENCES                                         VORLAX    1424
C...            NONE.                                                     VORLAX    1425
C...            COMMONS                                                   VORLAX    1426
C...            LAX.                                                      VORLAX    1427
C...                                                                      VORLAX    1428
C...OUTPUT      CALLING SEQUENCES                                         VORLAX    1429
C...            NONE.                                                     VORLAX    1430
C...            COMMONS                                                   VORLAX    1431
C...            DL, XS, ITS, NPP, NAS, NYS, NZS, PDL, PSI, RCS,           VORLAX    1432
C...            SPC, VSS, CBAR, HEAD, MACH, NPAN, NVOR, RNCV, SLE1,       VORLAX    1433
C...            SLE2, SREF, VINF, XBAR, YAWQ, YNOT, ZBAR, ZLE1,           VORLAX    1434
C...            ZLE2, ZNOT, AINC1, AINC2, ALPHA, DNDX1, DNDX2,            VORLAX    1435
C...            GAMMA, LESWP, NMACH, PSPAN, ROLLQ, SYNTH, TAPER,          VORLAX    1436
C...            WSPAN, XAPEX, YAPEX, ZAPEX, CSTART, DELTAY, DELTAZ,       VORLAX    1437
C...            INTRAC, INVERS, IQUANT, LATRAL, NALPHA, PHIMED,           VORLAX    1438
C...            PITCHQ.                                                   VORLAX    1439
C...                                                                      VORLAX    1440
C...SUBROUTINES                                                           VORLAX    1441
C...CALLED      NONE.                                                     VORLAX    1442
C...                                                                      VORLAX    1443
C...DISCUSSION A MASTER FRAME OF REFERENCE IS ASSUMED IN DEFINING         VORLAX    1444
C...            A CONFIGURATION. THIS FRAME OF REFERENCE IS AN            VORLAX    1445
C...            ORTHOGONAL CARTESIAN COORDINATE SYSTEM, THE X-Z           VORLAX    1446
C...            BEING THE CENTERLINE PLANE WITH THE X-AXIS POINTING       VORLAX    1447
C...            DOWNSTREAM, AND THE Z-AXIS DIRECTED UPWARD, THE           VORLAX    1448
C...            Y-AXIS POINTS TO STARBOARD. THE ORIGIN OF THE SYS         VORLAX    1449
C...            TEM CAN BE ANY CONVEVIENT POINT IN THE X-Z PLANE.         VORLAX    1450
C...            THE CONFIGURATION CAN BE MADE UP OF SYMMETRICAL           VORLAX    1451
C...            (ABOUT THE X-Z PLANE) AND/OR ASYMMETRICAL COMPO-          VORLAX    1452
C...            NENTS, AND IN DEFINING THE SYMMETRICAL COMPONENTS         VORLAX    1453
C...            ONLY THE STARBOARD ELEMENTS ARE SPECIFIED. THE            VORLAX    1454
C...            CONFIGURATION TO BE INPUT IS DIVIDED INTO A SET           VORLAX    1455
C...            OF MAJOR PANELS, UP TO 20 OF THESE PANELS CAN BE          VORLAX    1456
C...            INPUT, SYMMETRICAL COMPONENTS (LEFT + RIGHT) BEING        VORLAX    1457
C...            COUNTED ONLY ONCE. FOR INSTANCE, A WING OF ZERO           VORLAX    1458
C...            THICKNESS AND WITH STRAIGHT LEADING AND TRAILING          VORLAX    1459
C...            EDGES, AND WITH LINEAR LOFTING BETWEEN ROOT AND           VORLAX    1460
C...            TIP, CONSTITUTES A MAJOR PANEL. COMPLEX PLANFORMS,        VORLAX    1461
C...            AND NON-LINEAR CHANGES IN TWIST AND AIRFOIL SECTIONS      VORLAX    1462
C...            ARE DESCRIBED BY DEFINING MORE THAN ONE PANEL FOR A       VORLAX    1463
C...            GIVEN WING. SUBROUTINE INPUT PREPARES THE DATA SPE        VORLAX    1464
C...            CIFIED FOR EACH MAJOR PANEL SO THAT THEY CAN LATER        VORLAX    1465
C...            BE USED IN SUBROUTINE GEOM TO GENERATE THE PROPER         VORLAX    1466
C...            VORTEX LATTICE FOR EACH PANEL.                            VORLAX    1467
C...            AN AIRFOIL WITH THICKNESS CAN BE REPRESENTED BY A         VORLAX    1468
C...            DOUBLE VORTEX SHEET, I. E., BY DEFINING TWO MAJOR PA      VORLAX    1469
C...            NELS ARRANGED IN A #BIPLANE#, OR #SANDWICH#, FASHION,     VORLAX    1470
C...            ONE PANEL REPRESENTING THE UPPER SURFACE OF THE AIR       VORLAX    1471
C...            FOIL, AND THE OTHER PANEL REPRESENTING THE LOWER          VORLAX    1472
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C...           SURFACE OF THE SAME AIRFOIL.                           VORLAX    1473
C...           FUSIFORM BODIES ARE MODELLED BY DEFINING AN AUXILIARY  VORLAX    1474
C...           BODYIDENTICAL IN CROSS-SECTIONAL SHAPE AND LONGITUDI   VORLAX    1475
C...           NAL AREA DISTRIBUTION TO THE ACTUAL BODY BUT WITHOUT   VORLAX    1476
C...           CAMBER. THE AUXILIARY BODY CROSS-SECTION IS APPROXI    VORLAX    1477
C...           MATED BY A POLYGON WHOSE SIDES DETERMINE THE TRANS     VORLAX    1478
C...           VERSE LEGS OF THE HORSESHOE VORTICES. THE VERTICES     VORLAX    1479
C...           OF THE POLYGON AND THE AUXILIARY BODY AXIS DEFINE      VORLAX    1480
C...           A SET OF RADIAL PLANES IN WHICH THE BOUND TRAILING     VORLAX    1481
C...           LEGS OF THE HORSESHOE VORTICES LIE PARALLEL TO THE     VORLAX    1482
C...           AXIS. AS THE CROSS-SECTION CHANGES SHAPE ALONG THE     VORLAX    1483
C...           AXIS. THE POLYGON CHANGES ACCORDINGLY BUT WITH THE     VORLAX    1484
C...           CONSTRAINT THAT THE POLYGONAL VERTICES MUST ALWAYS     VORLAX    1485
C...           LIE IN THE SAME SET OF RADIAL PLANES. THE BODY CAMBER  VORLAX    1486
C...           IS SPECIFIED INDEPENDENTLY.                            VORLAX    1487
C...                                                                  VORLAX    1488
C...                                                                  VORLAX    1489
C...                                                                  VORLAX    1490
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CONTROL*VRLX.PRESS                                            9/15/76  VORLAX    2524
C...                                                                   VORLAX    2525
      SUBROUTINE PRESS (ITOTAL, EU)                                    VORLAX    2526
C                                                                      VORLAX    2527
C                                                                      VORLAX    2528
C...PURPOSE    TO COMPUTE PRESSURE LOAD COEFFICIENTS (CPLOWER          VORLAX    2529
C...           CPUPPER), OR SURFACE PRESSURE COFFFICIENTS, FROM THE    VORLAX    2530
C...           VALUES OF THE INDUCED VELOCITIES AND CIRCULATION        VORLAX    2531
C...           STRENGTHS.                                              VORLAX    2532
C...                                                                   VORLAX    2533
C...INPUT      CALLING SEQUENCES                                       VORLAX    2534
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.            VORLAX    2535
C...           EU = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED  VORLAX    2536
C...                ROW BY ROW FROM UNIT 2).                           VORLAX    2537
C...           COMMONS                                                 VORLAX    2538
C...           B2, CX, DL, SX, JTS, PSI, TNL, TNT, ALFA, YAWQ, CHORD,  VORLAX    2539
C...           GAMMA, ONSET, RNMAX, SLOPE, WSPAN.                      VORLAX    2540
C...                                                                   VORLAX    2541
C...OUTPUT     CALLING SEQUENCES                                       VORLAX    2542
C...           NONE.                                                   VORLAX    2543
C...           COMMONS                                                 VORLAX    2544
C...           DCP.                                                    VORLAX    2545
C...                                                                   VORLAX    2546
C...SUBROUTINES                                                        VORLAX    2547
C...CALLED     NONE.                                                   VORLAX    2548
C...                                                                   VORLAX    2549
C...DISCUSSION THIS SUBROUTINE COMPUTES THE PRESSURE COEFFICIENT ARRAY VORLAX    2550
C...           DCP. EACH ELEMENT OF DCP CORRESPONDS TO A GIVEN         VORLAX    2551
C...           HORSESHOE VORTEX OF THE LATTICE, AND IT IS ASSUMED TO   VORLAX    2552
C...           ACT AT THE HORSESHOE CENTROID, I.E., THE MI=            VORLAX    2553
C...           THE TRANSVERSE, OR SKEWED, LEG. AN ELEMENT OF THE DCP   VORLAX    2554
C...           ARRAY IS EITHER A LOAD COEFFICIENT (IF THE SURFACE      VORLAX    2555
C...           IS ASSUMED WETTED ON BOTH FACES, I.E., JTS = ITS = 1),  VORLAX    2556
C...           OR A SURFACE PRESSURE COEFFICIENT (IF THE SURFACE IS    VORLAX    2557
C...           ASSUMMED WETTED ON ONE SIDE ONLY, I.E., JTS = ITS = 0). VORLAX    2558
C...           IN THE COMPUTATION OF LOAD COEFFICIENTS, THE CIRCULA    VORLAX    2559
C...           TION STRENGTHS, THE FREE STREAM VELOCITY COMPONENTS,    VORLAX    2560
C...           AND THE ONSET FLOW DUE TO ANY ANGULAR ROTATION OF THE   VORLAX    2561
C...           CONFIGURATION ARE TAKEN INTO ACCOUNT. THE EFFECT OF     VORLAX    2562
C...           THE INDUCED AXIALWASH IS IGNORED (SECOND ORDER ERROR).  VORLAX    2563
C...           IN THE COMPUTATION OF SURFACE PRESSURE COEFFICIENTS,    VORLAX    2564
C...           THE AXIALWASH IS ALSO TAKEN INTO ACCOUNT. IF NPP = 1,   VORLAX    2565
C...           THE #AXIALWASH# IS NO LONGER A TRUE AXIALWASH (X-AXIS   VORLAX    2566
C...           VELOCITY COMPONENT), RATHER IT REPRESENTS THE VELOCITY  VORLAX    2567
C...           COMPONENT TANGENTIAL TO THE SURFACE BUT WITH THE SIDE   VORLAX    2568
C...           WASH LEFT OUT. SURFACE PRESSURE COEFFICIENTS ARE LIMI   VORLAX    2569
C...           TED BY THE ISENTROPIC VALUES CORRESPONDING TO STAGNA    VORLAX    2570
C...           TION AND 70 PERCENT OF VACUUM FOR THE GIVEN FREE-STREAM VORLAX    2571
C...           MACH NUMBER.                                            VORLAX    2572
C...                                                                   VORLAX    2573
C...                                                                   VORLAX    2574
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CONTROL*VRLX.PRINT                                              9/17/76
C...
      SUBROUTINE PRINT (ITOTAL, EW, EWX, EWY)
C...
C...PURPOSE     TO PRINT PROGRAM DATA.
C
C...INPUT       CALLING SEQUENCES
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.
C...            EW, EWX, EWY = STORAGE ARRAYS SET ASIDE FOR CALLING
C...                           SUBROUTINE MAP.
C...            COMMONS
C...            CD, CL, CM, CN, CX, CY, DL, IH, IQ, YY, ZC, ZZ,
C...            BIG, CDC, CNC, CRM, CYM, DCP, EPS, HAG, JTS, LAX,
C...            NXS, PDL, PSI, RLM, SPC, CBAR, CMTC, CSUC, HEAD,
C...            IPAN, ITER, LIFT, MACH, NPAN, NVOR, RNCV, SREF,
C...            SURF, VINF, XBAR, XSUC, YAWQ, ZBAR, AINC1, AINC2,
C...            ALPHA, CDTOT, CHORD, CLTOT, CMTOT, CRTOT, CYTOT,
C...            DNDX1, DNDX2, GAMMA, ISOLV, LESWP, PSPAN, RNMAX,
C...            ROLLQ, SLOPE, SYNTH, TAPER, TITLE, WSPAN, XAPEX,
C...            YAPEX, ZAPEX, CSTART, FLOATX, FLOATY, INVERS,
C...            IQUANT, ITRMAX, LATRAL, MOMENT, PITCHQ.
C...
C...OUTPUT      CALLING SEQUENCES
C...            NONE.
C...            COMMONS
C...            NONE.
C...
C...SUBROUTINES
C...CALLED      ZNORM, MAP.
C...
C...DISCUSSION THE DATA PRINTED OUT BY THIS SUBROUTINE ARE ARRANGED
C...            IN THREE GROUPS, AS FOLLOWSS
C...            (1) INPUT DATA, THESE ARE DATA WHICH ARE TAKEN FROM
C...                THE INPUT DECK AND HAVE BEEN CONVERTED IN A FORMAT
C...                SUITABLE FOR USE BY THE PROGRAM.
C...            (2) PANEL AND TOTAL CONFIGURATION FORCE AND MOMENT
C...                COEFFICIENT DATA.
C...            (3) DATA WHICH ARE RELATED EITHER TO CHORDWISE STRIPS
C...                OR TO INDIVIDUAL HORSESHOE VORTICES.
C...            THESE THREE DATA GROUPS ARE PRINTED SEQUENTIALLY.
C...            IF A FLOW FIELD SURVEY HAS BEEN REQUESTED, THE CORRES
C...            PONDING DATA ARE PRINTED OUT THROUGH SUBROUTINE MAP.
C...
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CONTROL*VRLX.SURVEY                                        9/17/76  VORLAX    3055
C...                                                                VORLAX    3056
      SUBROUTINE SURVEY (EW, EWX, EWY, ITOTAL)                      VORLAX    3057
C...                                                                VORLAX    3058
C...PURPOSE     TO GENERATE THREE AERODYNAMIC INFLUENCE COEFFICIENT VORLAX    3059
C...            MATRICESS (1) THE UPWASH AT THE FLOW FIELD SURVEY   VORLAX    3060
C...            POINTS (EW / UNIT 3), (2) THE AXIALWASH AT THE FLOW VORLAX    3061
C...            FIELD SURVEY POINTS (EWX / UNIT 4), AND (3) THE     VORLAX    3062
C...            SIDEWASH AT THE FLOW FIELD SURVEY POINTS (EWY / UNIT 7). VORLAX    3063
C...            THESE MATRICES REPRESENT THE INDUCED VELOCITY FIELD VORLAX    3064
C...            DUE TO THE HORSESHOE VORTICES OF THE LATTICE. THIS FLOW VORLAX    3065
C...            FIELD IS MEASURED AT THE NODAL POINTS OF A SPECIFIED VORLAX    3066
C...            3-D GRID.                                           VORLAX    3067
C...                                                                VORLAX    3068
C...INPUT       CALLING SEQUENCES                                   VORLAX    3069
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.        VORLAX    3070
C...            COMMONS                                             VORLAX    3071
C...            X, B2, CX, DL, NT, SX, XS, YY, ZZ, HAG, LAX, NXS,   VORLAX    3072
C...            NYS, NZS, PSI, TNT, VSP, VST, XTE, ALFA, YNOT, XBAR, VORLAX    3073
C...            ZBAR, ZNOT, CHORD, RNMAX, DELTAY, DELTAZ, FLOATX,   VORLAX    3074
C...            FLOATY, LATRAL.                                     VORLAX    3075
C...                                                                VORLAX    3076
C...OUTPUT      CALLING SEQUENCES                                   VORLAX    3077
C...            EW = UPWASH MATRIX (STORED ROW BY ROW IN UNIT 3)    VORLAX    3078
C...            EWX = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 4) VORLAX    3079
C...            EWY = SIDEWASH MATRIX (STORED ROW BY ROW IN UNIT 7) VORLAX    3080
C...            COMMONS                                             VORLAX    3081
C...            NONE.                                               VORLAX    3082
C...                                                                VORLAX    3083
C...SUBROUTINES                                                     VORLAX    3084
C...CALLED      WASH, UXVEL.                                        VORLAX    3085
C...                                                                VORLAX    3086
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES ARE VORLAX    3087
C...            GENERATED BY COMPUTING THE VELOCITY INDUCED AT A FLOW VORLAX    3088
C...            FIELD SURVEY POINT BY THE (K, J) HORSESHOE VORTEX OF VORLAX    3089
C...            UNIT STRENGTH. IF THE FLOW FIELD SURVEY POINT IS    VORLAX    3090
C...            WITHIN A GIVEN NEAR FIELD RADIUS OF THE INDUCING    VORLAX    3091
C...            HORSESHOE VORTEX THEN THE AXIALWASH CONTRIBUTION IS VORLAX    3092
C...            COMPUTED BY INTERDIGITATED VORTEX SPLITTING. THE FLOW VORLAX    3093
C...            FIELD SURVEY POINTS ARE THE NODAL POINTS OF A 3-D GRID VORLAX    3094
C...            DEFINED BY A SET OF THREE ORTHOGONAL PLANES. THESE  VORLAX    3095
C...            PLANES ARE SPECIFIED BY THE INPUT VALUES OF XS, YNOT, VORLAX    3096
C...            DELTAY, ZNOT, AND DELTAZ.                           VORLAX    3097
C...                                                                VORLAX    3098
C...                                                                VORLAX    3099
C...                                                                VORLAX    3100
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CONTROL*VRLX.UXVEL                                                  9/14/76
C...
      SUBROUTINE UXVEL (X, Y, Z, S, T, B2, TOLZ, U)
C...
C...PURPOSE     TO COMPUTE THE AXIALWASH INDUCED BY A SKEWED
C...            RECTILINEAR VORTEX SEGMENT OF UNIT CIRCULATION.
C...
C...INPUT       CALLING SEQUENCES
C...            X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF
C...                      RECEIVING POINT MEASURED IN A REFERENCE FRAME
C...                      CENTERED AT THE MIDPOINT OF VORTEX SEGMENT,
C...                      THE X-AXIS IS PARALLEL TO THE X-AXIS OF THE
C...                      MASTER (CONFIGURATION) COORDINATE SYSTEM, THE
C...                      Y-AXIS IS NORMAL TO THE X-AXIS BUT LIES IN
C...                      THE PLANE DETERMINED BY THE X-AXIS AND THE
C...                      VORTEX SEGMENT, AND THE Z-AXIS IS NORMAL TO
C...                      SUCH PLANE.
C...            S = SEMISPAN OF VORTEX SEGMENT.
C...            T = TANGENT OF SWEEP ANGLE OF VORTEX SEGMENT.
C...            B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).
C...            TOLZ = NUMERICAL TOLERANCE CONSTANT.
C...            COMMONS
C...            NONE.
C...
C...OUTPUT      CALLING SEQUENCES
C...            U = X-AXIS VELOCITY COMPONENT (AXIALWASH) INDUCED BY
C...                SKEWED VORTEX SEGMENT OF UNIT INTENSITY.
C...            COMMONS
C...            NONE.
C...
C...SUBROUTINES
C...CALLED      NONE.
C...
C...DISCUSSION THIS SUBROUTINE IS CALLED WHEN THE AXIALWASH IS
C...            COMPUTED IN ACCORDANCE WITH VORTEX SPLITTING SCHEME.
C...            ONLY THE AXIALWASH IS COMPUTED, AND ONLY THE TRANS
C...            VERSE SEGMENT OF THE HORSESHOE IS TAKEN INTO ACCOUNT.
C...            THE SAME COMMENTS PRESENTED IN SUBROUTINE WASH
C...            REGARDING THE NUMERICAL SINGULARITY IN THE VICINITY
C...            OF THE CHARACTERISTIC SURFACES (MACH CONES) ARE
C...            ALSO APPLICABLE HERE. SUBROUTINE UXVEL IS A DIRECT
C...            COPY OF PARTS OF SUBROUTINE WASH.
C...
C...
```

```
CONTROL*VRLX.VECTOR                                             9/14/76  VORLAX    3484
C...                                                                     VORLAX    3485
      SUBROUTINE VECTOR (ITOTAL, NX1, AV, EW, VORI, VORK, VORL)          VORLAX    3486
C                                                                        VORLAX    3487
C                                                                        VORLAX    3488
C...PURPOSE     TO SOLVE THE LINEAR SYSTEM OF BOUNDARY CONDITION         VORLAX    3489
C...            EQUATIONS BY PURCELL≠S VECTOR ORTHOGONALIZATION          VORLAX    3490
C...            METHOD.                                                  VORLAX    3491
C...                                                                     VORLAX    3492
C...INPUT       CALLING SEQUENCES                                        VORLAX    3493
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.             VORLAX    3494
C...            NX1 = ITOTAL + 1                                         VORLAX    3495
C...            EW = ROW OF NORMALWASH INFLUENCE COEFFICIENT MATRIX.     VORLAX    3496
C...            COMMONS                                                  VORLAX    3497
C...            ALOC.                                                    VORLAX    3498
C...                                                                     VORLAX    3499
C...OUTPUT      CALLING SEQUENCES                                        VORLAX    3500
C...            VORI = AUXILIARY COMPUTATIONAL ROW VECTOR.               VORLAX    3501
C...            VORK = EXTENDED SOLUTION ROW VECTOR.                     VORLAX    3502
C...            VORL = AUXILIARY COMPUTATIONAL ROW VECTOR.               VORLAX    3503
C...            COMMONS                                                  VORLAX    3504
C...            GAMMA.                                                   VORLAX    3505
C...                                                                     VORLAX    3506
C...SUBROUTINES                                                          VORLAX    3507
C...CALLED      NONE.                                                    VORLAX    3508
C...                                                                     VORLAX    3509
C...DISCUSSION THE BOUNDARY CONDITION EQUATIONS ARE SOLVED DIRECTLY      VORLAX    3510
C...            BY A VECTOR ORTHOGONALIZATION PROCEDURE (PURCELL≠S       VORLAX    3511
C...            VECTOR METHOD). SETS OF LINEARLY INDEPENDENT VECTORS     VORLAX    3512
C...            ARE CONSTRUCTED WHICH ARE SUCCESIVELY ORTHOGONAL TO      VORLAX    3513
C...            EACH ROW. WHEN ALL ROWS HAVE BEEN CONSIDERED THERE IS    VORLAX    3514
C...            ONE VECTOR WHICH IS NORMAL (ORTHOGONAL) TO ALL ROWS      VORLAX    3515
C...            AND CONTAINS THE SOLUTION VECTOR. NO MATRIX INVERSION    VORLAX    3516
C...            IS INVOLVED AND ONLY ONE ROW OF THE COEFFICIENT MATRIX   VORLAX    3517
C...            IS REQUIRED AT A TIME, AND ONCE OPERATED ON CAN BE       VORLAX    3518
C...            OVERWRITTEN. IN ADDITION, TWO AUXILIARY ROW VECTORS      VORLAX    3519
C...            ARE NEEDED FOR TEMPORARY STORAGE OF INTERMEDIATE VECTOR  VORLAX    3520
C...            VECTOR DATA.                                             VORLAX    3521
C...                                                                     VORLAX    3522
C...                                                                     VORLAX    3523
```

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CONTROL*VRLX.WASH                                                 9/14/76  VORLAX    3611
C...                                                                       VORLAX    3612
      SUBROUTINE WASH (X, Y, Z, S, T, B2, U, V, W, AA, AM, TE, CT, MM)     VORLAX    3613
C...                                                                       VORLAX    3614
C...PURPOSE     TO COMPUTE THE THREE VELOCITY COMPONENTS INDUCED AT A      VORLAX    3615
C...            GIVEN POINT BY A GENERALIZED HORSESHOE VORTEX OF UNIT      VORLAX    3616
C...            STRENGTH.                                                  VORLAX    3617
C                                                                          VORLAX    3618
C...INPUT       CALLING SEQUENCES                                          VORLAX    3619
C...            X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF              VORLAX    3620
C...                      RECEIVING (FIELD OR CONTROL) POINT MEASURED      VORLAX    3621
C...                      IN A REFERENCE FRAME CENTERED AT THE MIDPOINT    VORLAX    3622
C...                      OF THE TRANSVERSE VORTEX SEGMENT (HORSESHOE      VORLAX    3623
C...                      VORTEX CENTROID), THE X-AXIS IS PARALLEL TO      VORLAX    3624
C...                      THE X-AXIS OF THE MASTER (CONFIGURATION)         VORLAX    3625
C...                      COORDINATE SYSTEM, THE Y-AXIS IS NORMAL TO       VORLAX    3626
C...                      THE X-AXIS BUT LIES IN THE PLANE DETERMINED      VORLAX    3627
C...                      BY THE X-AXIS ITSELF AND THE TRANSVERSE LEG      VORLAX    3628
C...                      OF THE HORSESHOE, AND THE Z-AXIS IS NORMAL       VORLAX    3629
C...                      TO SUCH PLANE.                                   VORLAX    3630
C...            S = HORSESHOE VORTEX SEMISPAN.                             VORLAX    3631
C...            T = TANGENT OF SWEEP ANGLE OF TRANSVERSE LEG, POSITIVE     VORLAX    3632
C...               FOR SWEEPBACK.                                          VORLAX    3633
C...            B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).            VORLAX    3634
C...            AA, AM = DIRECTION ANGLES (ANGLES OF FLOATATION) OF        VORLAX    3635
C...                     FREE (WAKE) TRAILING LEGS.                        VORLAX    3636
C...            TE = TANGENT OF TRAILING EDGE SWEEP ANGLE.                 VORLAX    3637
C...            CT = AVERAGE LENGTH OF BOUND TRAILING LEGS OF HORSESHOE    VORLAX    3638
C...                 (DISTANCE BETWEEN VORTEX CENTROID AND TRAILING        VORLAX    3639
C...                 EDGE MEASURED ALONG X-AXIS).                          VORLAX    3640
C...            MM = FLOATING WAKE COMPUTATION FLAG.                       VORLAX    3641
C...            COMMONS                                                    VORLAX    3642
C...            NONE.                                                      VORLAX    3643
C...                                                                       VORLAX    3644
C...OUTPUT      CALLING SEQUENCES                                          VORLAX    3645
C...            U, V, W = ORTHOGONAL VELOCITY COMPONENTS INDUCED BY        VORLAX    3646
C...                      GENERALIZED HORSESHOE VORTEX OF UNIT             VORLAX    3647
C...                      CIRCULATION INTENSITY.                           VORLAX    3648
C...                                                                       VORLAX    3649
C...SUBROUTINES                                                            VORLAX    3650
C...CALLED      NONE.                                                      VORLAX    3651
C...                                                                       VORLAX    3652
C...DISCUSSION THE (GENERALIZED) HORSESHOE VORTEX ELEMENT CONSISTS OF      VORLAX    3653
C...            FIVE LEGS OR SEGMENTS, OF WHICH THREE ARE (BOUND) AND      VORLAX    3654
C...            TWO ARE (FREE) OR (FLOATING). THE BOUND LEGS ARE THE       VORLAX    3655
C...            SKEWED, OR SWEPT, TRANSVERSE SEGMENT AND THE TWO           VORLAX    3656
C...            TRAILING, OR CHORDWISE, FILAMENTS EXTENDING FROM THE       VORLAX    3657
C...            ENDS OF THE TRANSVERSE LEG TO THE TRAILING EDGE. THE       VORLAX    3658
C...            FLOATING TRAILING LEGS ARE THE SEMI-INFINITE LINES         VORLAX    3659
C...            WHICH START AT THE TRAILING EDGE AND CONTINUE TO           VORLAX    3660
C...            DOWNSTREAM INFINITY ACCORDING TO A PRESCRIBED DIRECTION    VORLAX    3661
C...            DETERMINED BY THE FLOATATION ANGLES AA AND AM. THESE       VORLAX    3662
C...            FLOATING TRAILING LEGS CONSTITUTE THE CONTINUATION         VORLAX    3663
C...            IN THE WAKE OF THE BOUND TRAILING SEGMENTS.                VORLAX    3664
C...            AT SUPERSONIC MACH NUMBERS THE VELOCITY INDUCED BY A       VORLAX    3665
C...            DISCRETE HORSESHOE VORTEX BECOMES VERY LARGE IN THE        VORLAX    3666
C...            VICINITY OF THE MACH AFTCONES GENERATED BY THE SKEWED      VORLAX    3667
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C...          LEG OF THE HORSESHOE. AT THE CHARACTERISTIC ENVELOPE     VORLAX    3668
C...          ITSELF, THE INDUCED VELOCITY VANISHES DUE TO THE FINITE  VORLAX    3669
C...          PART CONCEPT. THIS SINGULAR BEHAVIOR OCCURS ONLY FOR     VORLAX    3670
C...          FIELD POINTS OFF THE PLANE OF THE HORSESHOE. TO AVOID    VORLAX    3671
C...          THIS NUMERICAL SINGULARITY THE CHARACTERISTIC SURFACES   VORLAX    3672
C...          (MACH CONES) ARE TAKEN TO BE GIVEN BY                    VORLAX    3673
C...          (X - X1) **2 = B2 *((Y - Y1) **2 + (Z -Z1) **2) /CUTOFF  VORLAX    3674
C...          WHERE CUTOFF IS A NUMERICAL CONSTANT WHOSE VALUE IS      VORLAX    3675
C...          LESS THAN, BUT CLOSE TO, 1.0 .                           VORLAX    3676
C...                                                                   VORLAX    3677
C...                                                                   VORLAX    3678
C...                                                                   VORLAX    3679
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CONTROL*VRLX.ZNORM                                              9/14/76  VORLAX    3894
C...                                                                     VORLAX    3895
      SUBROUTINE ZNORM (I, IS, RTOP)                                     VORLAX    3896
C...                                                                     VORLAX    3897
C...PURPOSE     TO INTEGRATE THE CHORDWISE SLOPE DISTRIBUTION IN ORDER   VORLAX    3898
C...            TO OBTAIN THE SURFACE CAMBER (OR WARP) ORDINATES.        VORLAX    3899
C                                                                        VORLAX    3900
C...INPUT       CALLING SEQUENCES                                        VORLAX    3901
C...            I = ELEMENT INDEX (TOTAL COUNT).                         VORLAX    3902
C...            IS = STRIP INDEX (SPANWISE COUNT).                       VORLAX    3903
C...            RNMAX = NUMBER OF HORSESHOE VORTICES IN A GIVEN STRIP    VORLAX    3904
C...                    (CHORDWISE ROW).                                 VORLAX    3905
C...            COMMONS                                                  VORLAX    3906
C...            LAX, SLE, SLOPE.                                         VORLAX    3907
C                                                                        VORLAX    3908
C...OUTPUT      CALLING SEQUENCES                                        VORLAX    3909
C...            NONE.                                                    VORLAX    3910
C...            COMMONS                                                  VORLAX    3911
C...            ZC.                                                      VORLAX    3912
C...                                                                     VORLAX    3913
C...SUBROUTINES                                                          VORLAX    3914
C...CALLED      NONE.                                                    VORLAX    3915
C...                                                                     VORLAX    3916
C...DISCUSSION THIS SUBROUTINE COMPUTES THE CAMBER NORMAL ORDINATES      VORLAX    3917
C...            BY TRAPEZOIDAL INTEGRATION OF THE SURFACE SLOPE DIS      VORLAX    3918
C...            TRIBUTION ALONG THE CHORD. THIS SUBROUTINE IS ONLY       VORLAX    3919
C...            CALLED (BY SUBROUTINE PRINT) WHEN THE DESIGN PROCESS     VORLAX    3920
C...            IS INVOKED (INVERS = 1). IN SUCH A CASE, THE LOAD DIS    VORLAX    3921
C...            TRIBUTION HAS BEEN INPUT, AND THE SURFACE WARP NEEDED    VORLAX    3922
C...            TO ACHIEVE IT IS THE DESIRED OUTPUT. THE CAMBERLINE IS   VORLAX    3923
C...            DEFINED AS BEING ZERO AT THE LEADING EDGE AND IS         VORLAX    3924
C...            EXPRESSED AS DECIMAL FRACTION OF THE LOCAL CHORD         VORLAX    3925
C...            LENGTH. THE COMPUTED CAMBERLINE REPRESENTS THE TOTAL     VORLAX    3926
C...            SURFACE WARP, I.E., IT INCLUDES CAMBER AND TWIST.        VORLAX    3927
C...            SUBROUTINE ZNORM IS CALLED ONCE PER EACH CHORDWISE       VORLAX    3928
C...            STRIP OR ROW OF HORSESHOE VORTICES.                      VORLAX    3929
C                                                                        VORLAX    3930
C                                                                        VORLAX    3931
C                                                                        VORLAX    3932
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CONTROL*VRLX.AAMAINCD                                             9/16/7 VORLAX       2
C*********************************************************************** VORLAX       3
C                                                                        VORLAX       4
C                                                                        VORLAX       5
C        L       000    CCCC  K   K  H   H  EEEEE  EEEEE  DDDD           VORLAX       6
C        L      0   0  C      K  K   H   H  E      E      D   D          VORLAX       7
C        L      0   0  C      K K    H   H  E      E      D   D          VORLAX       8
C        L      0   0  C      KK     HHHHH  EEEEE  EEEEE  D   D          VORLAX       9
C        L      0   0  C      K K    H   H  E      E      D   D          VORLAX      10
C        L      0   0  C      K  K   H   H  E      E      D   D          VORLAX      11
C        LLLLL   000    CCCC  K   K  H   H  EEEEE  EEEEE  DDDDD          VORLAX      12
C                                                                        VORLAX      13
C                                                                        VORLAX      14
C                                                                        VORLAX      15
C   PPPPP RRRRR  000  PPPPP RRRRR IIIII EEEEE TTTTT  AAA  RRRRR Y   Y    VORLAX      16
C   P   P R   R 0   0 P   P R   R   I   E       T   A   A R   R  Y Y     VORLAX      17
C   PPPPP RRRRR 0   0 PPPPP RRRRR   I   EEEEE   T   AAAAA RRRRR   Y      VORLAX      18
C   P     R  R  0   0 P     R  R    I   E       T   A   A R  R    Y      VORLAX      19
C   P     R   R 0   0 P     R   R   I   E       T   A   A R   R   Y      VORLAX      20
C   P     R   R  000  P     R   R IIIII EEEEE   T   A   A R   R   Y      VORLAX      21
C                                                                        VORLAX      22
C*********************************************************************** VORLAX      23
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C*********************************************************************** VORLAX      30
C                                                                        VORLAX      31
C  GENERALIZED VORTEX LATTICE PROGRAM (SUBSONIC/SUPERSONIC NONPLANAR)    VORLAX      32
C  LUIS R. MIRANDA (DEPT. 75-41) /BLDG. 63G /(213) 847-6812/             VORLAX      33
C  WILLIAM M. BAKER (DEPT. 80-34) /BLDG. 67 /(213) 847-3537/             VORLAX      34
C  ***** LOCKHEED-CALIFORNIA COMPANY, BURBANK, CALIFORNIA *****          VORLAX      35
C  COMPUTER SERVICES JOB NUMBER  4565                                    VORLAX      36
C                                                                        VORLAX      37
C*********************************************************************** VORLAX      38
C                                                                        VORLAX      39
C                                                                        VORLAX      40
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- VORLAX      41
C                                                                        VORLAX      42
C          V       V  000   RRRRR  L         A      X   X                VORLAX      43
C           V     V  0   0  R   R  L        A A      X X                 VORLAX      44
C            V   V   0   0  RRRRR  L       AAAAA      X                  VORLAX      45
C             V V    0   0  R  R   L      A     A    X X                 VORLAX      46
C              V       000   R   R  LLLLL A       A  X   X               VORLAX      47
C                                                                        VORLAX      48
C-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*- VORLAX      49
C                                                                        VORLAX      50
C                                                                        VORLAX      51
      PROGRAM VORLAX(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2,  VORLAX      52
     *TAPE3,TAPE4,TAPE7,TAPE9,TAPE11,TAPE12)                             VORLAX      53
C...                                                                     VORLAX      54
C...DEFINITION OF VARIABLES STORED IN COMMON BLOCKS.                     VORLAX      55
C...                                                                     VORLAX      56
C...X, Y, Z             COORDINATES OF HORSESHOE VORTEX CENTROIDS        VORLAX      57
C...                    (MIDPOINTS OF TRANSVERSE LEGS).                  VORLAX      58
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      C...B2               COMPRESSIBILITY FACTOR (M **2 - 1.)          VORLAX   59
      C...CD, CL, CM, CN   PANEL DRAG, LIFT, PITCHING MOMENT, AND NORMAL VORLAX   60
      C...                 FORCE COEFFICIENTS.                          VORLAX   61
      C...CX, CY           PANEL X- AND Y-FORCE COEFFICIENTS.           VORLAX   62
      C...DL               DIHEDRAL OF CHORDWISE ROW OF HORSESHOE VORTI VORLAX   63
      C...                 CES.                                         VORLAX   64
      C...FN, FY           PANEL NORMAL AND Y-FORCE PER UNIT Q.         VORLAX   65
      C...IM, IQ           ANGLE OF ATTACK AND MACH NUMBER INDICES.     VORLAX   66
      C...NT               TOTAL NUMBER OF CHORDWISE ROWS OF VORTICES.  VORLAX   67
      C...RM               PANEL ROLLING MOMENT PER UNIT Q.             VORLAX   68
      C...SX               SPANWISE LOCATION INDEX.                     VORLAX   69
      C...XS               ABSCISSAE OF FLOW FIELD SURVEY CROSS-PLANES. VORLAX   70
      C...YM               PANEL YAWING MOMENT PER UNIT Q.              VORLAX   71
      C...YY               Y-COORDINATE OF HORSESHOE VORTEX CENTROIDS.  VORLAX   72
      C...ZC               NORMAL CAMBER COORDINATE IN FRACTION OF CHORD. VORLAX 73
      C...ZZ               Z-COORDINATE OF HORSESHOE VORTEX CENTROIDS.  VORLAX   74
      C...BIG              MAXIMUM CHANGE PER RELAXATION CYCLE.         VORLAX   75
      C...CDC, CNC         CHORDWISE CD AND CN TIMES LOCAL CHORD.       VORLAX   76
      C...CRM, CYM         PANEL ROLLING AND YAWING MOMENT COEFFICIENTS. VORLAX  77
      C...DCP              PRESSURE COEFFICIENTS (EITHER LOAD OR        VORLAX   78
      C...                 SURFACE).                                    VORLAX   79
      C...EPS              ACCEPTABLE FINAL RELAXATION CYCLE CHANGE.    VORLAX   80
      C...HAG              HEIGHT ABOVE GROUND OF MOMENT REFERENCE      VORLAX   81
      C...                 CENTER.                                      VORLAX   82
      C...ITS, JTS         PANEL AND STRIP FLOW EXPOSURE FLAGS.         VORLAX   83
      C...LAX,LAY          LATTICE CHORDWISE AND SPANWISE DISTRIBUTION  VORLAX   84
      C...                 FLAGS.                                       VORLAX   85
      C...NPP              PANEL CHORDWISE NONPLANARITY FLAG.           VORLAX   86
      C...NXS, NYS, NZS    NUMBER OF FLOW FIELD SURVEY PLANES (ORTHOGO  VORLAX   87
      C...                 NAL TO THE COORDINATE AXES).                 VORLAX   88
      C...PDL              PANEL SPANWISE NONPLANARITY FLAG, ALSO PANEL VORLAX   89
      C...                 PANEL DIHEDRAL IF PANEL IS FLAT IN THE SPAN  VORLAX   90
      C...                 WISE DIRECTION.                              VORLAX   91
      C...PSI              YAW ANGLE (POSITIVE WHEN FLOW COMES FROM     VORLAX   92
      C...                 PORTSIDE).                                   VORLAX   93
      C...RCS              CROSS-SECTION RADIUS VECTOR.                 VORLAX   94
      C...RLM              APPROXIMATE VALUE OF EIGENVALUE RADIUS OF    VORLAX   95
      C...                 NORMALWASH MATRIX.                           VORLAX   96
      C...SLE              SLOPE AT LEADING EDGE.                       VORLAX   97
      C...SPC              PANEL LEADING EDGE SUCTION FACTOR.           VORLAX   98
      C...TNL              TANGENT OF LEADING EDGE SWEEP.               VORLAX   99
      C...TNT              TANGENT OF TRAILING EDGE SWEEP.              VORLAX  100
      C...VSP              TANGENT OF SKEWED VORTEX LINE.               VORLAX  101
      C...VSS              SEMISPAN OF CHORDWISE VORTEX ROW.            VORLAX  102
      C...VST              ACTUAL HORSESHOE VORTEX SEMISPAN.            VORLAX  103
      C...XAF              CHORDWISE PERCENT COORDINATES AT WHICH CAMBER VORLAX 104
      C...                 IS INPUT.                                    VORLAX  105
      C...XTE              TRAILING EDGE ABSCISSA OF VORTEX ROW.        VORLAX  106
      C...ALFA             ANGLE OF ATTACK (IN RADIANS).                VORLAX  107
      C...ALOC             COMPONENT OF FREE-STREAM AND ONSET FLOWS NOR VORLAX  108
      C...                 MAL TO THE SURFACE AT THE CONTROL POINTS, ALSO VORLAX 109
      C...                 AUXILIARY ARRAY.                             VORLAX  110
      C...BETA             PRANDTL-GLAUERT FACTOR.                      VORLAX  111
      C...CBAR             REFERENCE CHORD.                             VORLAX  112
      C...CMTC             CHORDWISE TORSIONAL MOMENT ABOUT QUARTER CHORD VORLAX 113
      C...                 TIMES LOCAL CHORD.                           VORLAX  114
      C...CSUC             PANEL LEADING EDGE THRUST PER UNIT Q.        VORLAX  115
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C...DRAG                 PANEL INDUCED DRAG PER UNIT Q.                    VORLAX   116
C...HEAD                 PANEL DESCRIPTION INFORMATION.                    VORLAX   117
C...IDES                 DESIGN (SYNTHESIS) FLAG.                          VORLAX   118
C...IPAN                 HORSESHOE STRIP PANEL INDEX.                      VORLAX   119
C...ITER                 ACTUAL NUMBER OF RELAXATION CYCLES.               VORLAX   120
C...LIFT                 PANEL LIFT PER UNIT Q.                            VORLAX   121
C...MACH                 FREE-STREAM MACH NUMBER.                          VORLAX   122
C...NPAN                 NUMBER OF PANELS DEFINED IN THE DATA INPUT.       VORLAX   123
C...NVOR                 NUMBER OF PANEL CHORDWISE STRIPS OF VORTICES.     VORLAX   124
C...RNCV                 CHORDWISE NUMBER OF HORSESHOE VORTICES FOR A      VORLAX   125
C...                     GIVEN PANEL.                                      VORLAX   126
C...SLE1, SLE2           SURFACE SLOPES AT LEADING EDGE OF PANEL SIDE      VORLAX   127
C...                     EDGES.                                            VORLAX   128
C...SMAX                 NT.                                               VORLAX   129
C...SREF                 CONFIGURATION REFERENCE AREA.                     VORLAX   130
C...SURF                 PANEL SURFACE AREA (PLANFORM AREA).               VORLAX   131
C...VINF                 REFERENCE FREE STREAM VELOCITY.                   VORLAX   132
C...XBAR                 ABSCISSA OF MOMENT REFERENCE CENTER.              VORLAX   133
C...XSUC                 PANEL LEADING EDGE THRUST PER UNIT Q.             VORLAX   134
C...YAWQ                 YAW RATE (DEGS/SEC).                              VORLAX   135
C...YNOT                 BUTTLINE ORIGIN OF FLOW FIELD SURVEY GRID.        VORLAX   136
C...ZBAR                 ORDINATE OF MOMENT REFERENCE CENTER.              VORLAX   137
C...ZETA                 INCIDENCE OF STREAMWISE VORTEX ROW (STRIP)        VORLAX   138
C...                     CHORDLINE.                                        VORLAX   139
C...ZLE1, ZLE2           LEADING EDGE OFFSET OF CAMBERLINE AT THE          VORLAX   140
C...                     PANEL SIDE EDGES.                                 VORLAX   141
C...ZNOT                 WATERLINE ORIGIN OF FLOW FIELD SURVEY GRID.       VORLAX   142
C...AINC1, AINC2         CHORDLINE INCIDENCE AT SIDE EDGES OF PANEL.       VORLAX   143
C...ALPHA                ANGLE OF ATTACK (DEGS).                           VORLAX   144
C...CDTOT                TOTAL INDUCED DRAG COEFFICIENT.                   VORLAX   145
C...CHORD                CHORD LENGTH MEASURED ALONG CENTRLINE OF          VORLAX   146
C...                     STREAMWISE ROW OF HORSESHOE VORTICES.             VORLAX   147
C...CLTOT                TOTAL LIFT COEFFICIENT.                           VORLAX   148
C...CMTOT                TOTAL PITCHING MOMENT COEFFICIENT.                VORLAX   149
C...CNTOT                TOTAL YAWING MOMENT COEFFICIENT.                  VORLAX   150
C...CRTOT                TOTAL ROLLING MOMENT COEFFICIENT.                 VORLAX   151
C...CYTOT                TOTAL SIDE FORCE COEFFICIENT.                     VORLAX   152
C...DNDX1, DNDX2         SURFACE SLOPES AT THE CONTROL POINTS MEASURED     VORLAX   153
C...                     ALONG THE PANEL SIDE EDGES. IF DESIGN IS IN       VORLAX   154
C...                     VOKED, THEY ARE THE LOAD COEFFICIENTS AT THE      VORLAX   155
C...                     LOAD POINTS ALONG THE PANEL SIDE EDGES.           VORLAX   156
C...GAMMA                HORSESHOE VORTEX CIRCULATION , ALSO USED          VORLAX   157
C...                     AS TEMPORARY DATA STORAGE.                        VORLAX   158
C...ISOLV,               FLAG DETERMINING SYSTEM OF SOLUTION FOR THE       VORLAX   159
C...                     BOUNDARY CONDITION EQUATIONS.                     VORLAX   160
C...LESWP                PANEL LEADING EDGE SWEEP (DEGS).                  VORLAX   161
C...NMACH                NUMBER OF MACH NUMBERS PER CASE.                  VORLAX   162
C...ONSET                ONSET FLOW VELOCITIES GENERATED BY THE            VORLAX   163
C...                     ROTATION OF THE CONFIGURATION ABOUT THE           VORLAX   164
C...                     MOMENT REFERENCE CENTER.                          VORLAX   165
C...PSPAN                PANEL SPAN.                                       VORLAX   166
C...RFLAG                COEFFICIENT MULTIPLIER IN SYSTEM OF BOUNDARY      VORLAX   167
C...                     CONDITION EQUATIONS.                              VORLAX   168
C...RNMAX                NUMBER OF VORTICES FOR A GIVEN CHORDWISE ROW.     VORLAX   169
C...ROLLQ                ROLL RATE (DEGS/SEC).                             VORLAX   170
C...SLOPE                SURFACE SLOPE AT THE LATTICE CONTROL POINTS.      VORLAX   171
C...SYNTH                PANEL SYNTHESIS (DESIGN) FLAG.                    VORLAX   172
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C...TAPER              PANEL TAPER RATIO.                               VORLAX    173
C...TITLE              CASE TITLE.                                      VORLAX    174
C...WSPAN              CONFIGURATION REFERENCE WING SPAN.               VORLAX    175
C...XAPEX, YAPEX, ZAPE- COORDINATES OF PANEL FIRST SIDE EDGE LEADING    VORLAX    176
C...                   EDGE (PANEL APEX).                               VORLAX    177
C...CSTART             CHORD LENGTH OF PANEL FIRST SIDE EDGE.           VORLAX    178
C...DELTAY, DELTAZ     BUTTLINE AND WATERLINE SPACING OF FLOW FIELD     VORLAX    179
C...                   SURVEY GRID.                                     VORLAX    180
C...FLOATX, FLOATY     VORTEX WAKE FLOATATION PARAMETERS.               VORLAX    181
C...INTRAC             PANEL LATERAL NONPLANARITY PARAMETER.            VORLAX    182
C...INVERS             DESIGN (SYNTHESIS) FLAG.                         VORLAX    183
C...IQUANT             PANEL SYMMETRY FLAG.                             VORLAX    184
C...ITRMAX             MAXIMUM ALLOWABLE NUMBER OF RELAXATION CYCLES.   VORLAX    185
C...LATRAL             CONFIGURATION OR FLIGHT CONDITION SYMMETRY       VORLAX    186
C...                   FLAG.                                            VORLAX    187
C...MOMENT             PANEL PITCHING MOMENT PER UNIT Q.                VORLAX    188
C...NALPHA             NUMBER OF ANGLES OF ATTACK PER CASE.             VORLAX    189
C...NPANAS             TOTAL NUMBER OF PANELS THAT HAVE TO BE TAKEN     VORLAX    190
C...                   INTO ACCOUNT IN THE ACTUAL COMPUTATION           VORLAX    191
C...                   PROCESS.                                         VORLAX    192
C...PHIMED             ANGULAR COORDINATE OF CROSS-SECTION RADIUS       VORLAX    193
C...                   VECTOR.                                          VORLAX    194
C...PITCHQ             PITCH RATE (DEGS/SEC).                           VORLAX    195
C...                                                                    VORLAX    196
C......................(PER UNIT Q) MEANS (PER UNIT FREE-STREAM         VORLAX    197
C......................DYNAMIC PRESSURE).                               VORLAX    198
C...                                                                    VORLAX    199
C                                                                       VORLAX    200
C                                                                       VORLAX    201
      DIMENSION C1 (50), C2 (50), RO (51), PHI (51)                     VORLAX    202
      DIMENSION XAF (50), ZC1 (50), ZC2 (50)                            VORLAX    203
      DIMENSION EW (2000), EWX (2001), EWY (2001), EU (2001), AV (2001) VORLAX    204
      DIMENSION DESCRP (10)                                             VORLAX    205
C                                                                       VORLAX    206
      INTEGER TITLE, CX, SX                                             VORLAX    207
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                              VORLAX    208
C                                                                       VORLAX    209
C...                                                                    VORLAX    210
C...                                                                    VORLAX    211
      COMMON LAX, LAY, IQ, IR, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,   VORLAX    212
     * FLOATX, FLOATY, INVERS, ISOLV                                    VORLAX    213
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                 VORLAX    214
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                VORLAX    215
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)     VORLAX    216
      COMMON /SET4 /ONDX1 (400), ONDX2 (400), AINC1 (20), AINC2 (20)    VORLAX    217
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), POL (40),       VORLAX    218
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),    VORLAX    219
     * PSPAN (40), NVOR (40)                                            VORLAX    220
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                 VORLAX    221
      COMMON /SET7 /RNCV (20), RNMAX (100), IIS (20), JTS (100)         VORLAX    222
      COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),         VORLAX    223
     * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),            VORLAX    224
     * RM (40), CRM (40), YM (40), CYM (40), ASUC (40), SURF (40)       VORLAX    225
      COMMON /SET9 /CDC (100), CNC (100)                                VORLAX    226
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),       VORLAX    227
     * TNT (100), ATE (100), IPAN (100)                                 VORLAX    228
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA     VORLAX    229
      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT       VORLAX    230
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                  VORLAX    231
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                              VORLAX    232
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                           VORLAX    233
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                      VORLAX    234
      COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)                     VORLAX    235
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)   VORLAX    236
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)          VORLAX    237
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),       VORLAX    238
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)              VORLAX    239
C...                                                                      VORLAX    240
C...                                                                      VORLAX    241
C...                                                                      VORLAX    242
C...                                                                      VORLAX    243
      PI = 3.14159                                                        VORLAX    244
      DTR = .01745329                                                     VORLAX    245
C                                                                         VORLAX    246
C                                                                         VORLAX    247
   10 READ (5, 20) TITLE                                                  VORLAX    248
      WRITE (6, 50) TITLE                                                 VORLAX    249
      IF(EOF(5).NE.0) GO TO 110                                           VORLAX    250
   20 FORMAT (20A4)                                                       VORLAX    251
      READ (5, 30) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,          VORLAX    252
     * ITRMAX                                                             VORLAX    253
      IF (ITRMAX .EQ. 0 ) ITRMAX = 99                                     VORLAX    254
      IF (REXPAR .LT. 0.01) REXPAR = 0.10                                 VORLAX    255
      WRITE (6, 40) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,         VORLAX    256
     * ITRMAX                                                             VORLAX    257
   30 FORMAT (3 (I2, 8X), 4F10.0, 7X, I3)                                 VORLAX    258
   40 FORMAT (1H , 3 (I2, 8X), 4F10.2, 7X, I3)                            VORLAX    259
   50 FORMAT (1H1, 32H********** INPUT DECK **********,///1H , 20A4)      VORLAX    260
C                                                                         VORLAX    261
C...                                                                      VORLAX    262
C...                                                                      VORLAX    263
C...                                                                      VORLAX    264
      CALL INPUT                                                          VORLAX    265
      CALL GEOM (ITOTAL)                                                  VORLAX    266
C                                                                         VORLAX    267
   60 DO 100 IQ = 1, NMACH                                                VORLAX    268
      B2 = MACH (IQ) **2 - 1.0                                            VORLAX    269
      BETA = SQRT (ABS (B2))                                              VORLAX    270
      ALFA = 0.0                                                          VORLAX    271
      ICALL = 0                                                           VORLAX    272
      IF (FLOATX .NE. 0.0 .OR. HAG .NE. 0.0) ICALL = 1                    VORLAX    273
      IM = ICALL + NXS                                                    VORLAX    274
      IF (ICALL .EQ. 0) CALL MATRX (EW, EU, ITOTAL)                       VORLAX    275
      IF(IM .EQ. NXS .AND. IM .GT. 0) CALL SURVEY(EW, EWX, EWY, ITOTAL)   VORLAX    276
C                                                                         VORLAX    277
      DO 90 IH = 1, NALPHA                                                VORLAX    278
      ALFA = ALPHA (IH) *DTR                                              VORLAX    279
      IF (ICALL .EQ. 1) CALL MATRX (EW, EU, ITOTAL)                       VORLAX    280
      IF(IM.GT.NXS .AND. NXS .GT. 0) CALL SURVEY(EW, EWX, EWY, ITOTAL)    VORLAX    281
      NX1 = ITOTAL + 1                                                    VORLAX    282
      CALL BOUNDY (ITOTAL)                                                VORLAX    283
      IF (ISOLV .EQ. 0) CALL GAUSS (ITOTAL, REXPAR, EW, EWX)              VORLAX    284
      IF (ISOLV .EQ. 1) CALL VECTOR (ITOTAL, NX1, AV, EW, EU, EWX, EWY)   VORLAX    285
      CALL PRESS (ITOTAL, EU)                                             VORLAX    286
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                   CALL AERO (EW, ITOTAL)                                                         VORLAX      297
                   CALL PRINT (ITOTAL, EW, EWX, EWY)                                              VORLAX      298
              C                                                                                   VORLAX      299
                   IPASS = 1 - INVERS                                                             VORLAX      290
  290              INVERS = 0                                                                     VORLAX      291
                   IF (IPASS .EQ. 1) GO TO 90                                                     VORLAX      292
                   DO 70 IRR = 1, ITOTAL                                                          VORLAX      293
               70  IDES (IRR) = 0                                                                 VORLAX      294
                   GO TO 60                                                                       VORLAX      295
  295         C                                                                                   VORLAX      296
               80  FORMAT (1H1 , 20A4)                                                            VORLAX      297
               90  CONTINUE                                                                       VORLAX      298
              C                                                                                   VORLAX      299
              100  CONTINUE                                                                       VORLAX      300
  300         C                                                                                   VORLAX      301
                   GO TO 10                                                                       VORLAX      302
              110  WRITE (6, 80)                                                                  VORLAX      303
                   STOP                                                                           VORLAX      304
              C                                                                                   VORLAX      305
  305              END                                                                            VORLAX      306

ARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

    267     I                CONTROL VARIABLE IN COMMON OR EQUIVALENCED. OPTIMIZATION MAY BE INHIBITED.
    277     I                CONTROL VARIABLE IN COMMON OR EQUIVALENCED. OPTIMIZATION MAY BE INHIBITED.


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
24531   VORLAX

VARIABLES      SN  TYPE           RELOCATION
  1440  AINC1      REAL       ARRAY     SET4              1444  AINC2      REAL       ARRAY      SET4
    20  ALFA       REAL                 SET11              334  ALOC       REAL       ARRAY      SET6
    10  ALPHA      REAL       ARRAY     SET11            45276  AV         REAL       ARRAY
     1  BETA       REAL                 SET15                0  BIG        REAL                  SET13
     0  B2         REAL                 SET15                2  CHAR       REAL                  SET15
   240  CD         REAL       ARRAY     SET8                 0  CDC        REAL       ARRAY      SET9
     1  CDTOT      REAL                 SET12                0  CHORD      REAL       ARRAY      SET10
   170  CL         REAL       ARRAY     SET8                 0  CLTOT      REAL                  SET12
   310  CM         REAL       ARRAY     SET8               144  CMTC       REAL       ARRAY      SET17
     2  CMTOT      REAL                 SET12              430  CN         REAL       ARRAY      SET8
   144  CNC        REAL       ARRAY     SET9                 6  CNTOT      REAL                  SET12
   670  CRM        REAL       ARRAY     SET8                 5  CRTOT      REAL                  SET12
   430  CSTART     REAL       ARRAY     SET5                 0  CSUC       REAL       ARRAY      SET17
     0  CX         INTEGER    ARRAY     SET3               550  CY         REAL       ARRAY      SET8
  1010  CYM        REAL       ARRAY     SET8                 4  CYTOT      REAL                  SET12
 25033  C1         REAL       *UNDEF                     25115  C2         REAL       *UNDEF
     0  DCP        REAL       ARRAY     SET2                 4  DELTAY     REAL                  SET18
     6  DELTAZ     REAL                 SET18            51217  DESCHP     REAL       *UNDEF
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         PROGRAM VORLAX      74/74    OPT=1                            FTN 4.5+410A      10/04/76  10.15.13         PAGE      7

VARIABLES      SN  TYPE             RELOCATION
   144  DL         REAL        ARRAY    SET10            0  DNDX1       REAL        ARRAY     SET4
   620  DNDX2      REAL        ARRAY    SET4            50  DRAG        REAL        ARRAY     SETA
 25023  DTR        REAL                                  3  EPS         REAL                  SET13
 41355  EU         REAL        ARRAY                 25573  FW          REAL        ARRAY
 31513  EWX        REAL        ARRAY                 35434  FWY         REAL        ARRAY
    12  FLOATX     REAL                 / /             13  FLOATY      REAL                  / /
   360  FN         REAL        ARRAY    SET8           500  FY          REAL        ARRAY     SETA
     0  GAMMA      REAL        ARRAY    SET16           11  MAG         REAL                  / /
    24  HEAD       REAL        ARRAY    SET6         25026  ICALL       INTEGER
 13560  IDES       INTEGER     ARRAY    SE13             3  IH          INTEGER               / /
 25027  IM         INTEGER                             404  INTRAC      INTEGER     ARRAY     SET20
    14  INVERS     INTEGER              / /           1130  IPAN        INTEGER     ARRAY     SET10
 25031  IPASS      INTEGER                               2  IQ          INTEGER               / /
   360  IQUANT     INTEGER     ARRAY    SET5         25032  IRR         INTEGER
    15  ISOLV      INTEGER              / /              1  ITER        INTEGER               SET13
 25025  ITOTAL     INTEGER                               2  ITRMAX      INTEGER               SET13
   170  ITS        INTEGER     ARRAY    SET7           214  JTS         INTEGER     ARRAY     SET7
     4  LATRAL     INTEGER              / /              0  LAX         INTEGER               / /
     1  LAY        INTEGER              / /            240  LESWP       REAL        ARRAY     SET5
     0  LIFT       REAL        ARRAY    SETA             0  MACH        REAL        ARRAY     SET11
   120  MOMENT     REAL        ARRAY    SET8            23  NALPHA      INTEGER               SET11
    22  NMACH      INTEGER              SET11            0  NPAN        INTEGER               SET14
     3  NPANAS     INTEGER              SET14          360  NPP         INTEGER     ARRAY     SET20
     1  NT         INTEGER              SET14          620  NVOR        REAL        ARRAY     SET5
     0  NXS        INTEGER              SET18        25030  NX1         INTEGER
     1  NYS        INTEGER              SET18            2  NZS         INTEGER               SET18
  3720  ONSET      REAL        ARRAY    SET16          170  POL         REAL        ARRAY     SET5
 25262  PHI        REAL       *UNDEF                    50  PHIMED      REAL        ARRAY     SET20
 25022  PI         REAL                                  6  PITCHQ      REAL                  / /
     5  PSI        REAL                 / /            550  PSPAN       REAL        ARRAY     SET5
   214  RCS        REAL        ARRAY    SET20        25024  REXPAR      REAL
  7640  RFLAG      REAL        ARRAY    SET3             5  RLM         REAL                  SET13
   620  RM         REAL        ARRAY    SETA             0  RNCV        REAL        ARRAY     SET7
    24  RNMAX      REAL        ARRAY    SET7         25177  RO          REAL       *UNDEF
     7  ROLLQ      REAL                 / /             50  SLE         REAL        ARRAY     SET19
     0  SLE1       REAL        ARRAY    SET19           24  SLE2        REAL        ARRAY     SET19
  3720  SLOPE      REAL        ARRAY    SET2             2  SMAX        REAL                  SET14
   310  SPC        REAL        ARRAY    SET17            3  SREF        REAL                  SET12
  1130  SURF       REAL        ARRAY    SET8          3720  SX          INTEGER     ARRAY     SET3
   310  SYNTH      REAL        ARRAY    SET5           500  TAPER       REAL        ARRAY     SET5
     0  TITLE      INTEGER     ARRAY    SET6           454  TNL         REAL        ARRAY     SET10
   620  TNT        REAL        ARRAY    SET10           21  VINF        REAL                  SET11
  7640  VSP        REAL        ARRAY    SET2           310  VSS         REAL        ARRAY     SET10
 10270  VST        REAL        ARRAY    SET20            4  WSPAN       REAL                  SET13
     0  X          REAL        ARRAY    SET1         25345  XAF         REAL       *UNDEF
     0  XAPEX      REAL        ARRAY    SET5             3  XBAR        REAL                  SET15
     7  XS         REAL        ARRAY    SET18         1060  XSUC        REAL        ARRAY     SET8
   764  XTE        REAL        ARRAY    SET10         3720  Y           REAL        ARRAY     SET1
    50  YAPEX      REAL        ARRAY    SET5            10  YAWQ        REAL                  / /
   740  YM         REAL        ARRAY    SET8             3  YNOT        REAL                  SET18
   430  YY         REAL        ARRAY    SET20         4064  Z           REAL        ARRAY     SET1
   120  ZAPEX      REAL        ARRAY    SET5             4  ZBAR        REAL                  SET15
  4230  ZC         REAL        ARRAY    SET1         25427  ZC1         REAL       *UNDEF
 25511  ZC2        REAL       *UNDEF                   214  ZETA        REAL        ARRAY     SET19
     0  ZLE1       REAL        ARRAY    SET20           24  ZLE2        REAL        ARRAY     SET20
     5  ZNOT       REAL                 SET18         4350  ZZ          REAL        ARRAY     SET20
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        PROGRAM VORLAX     74/74    OPT=1                          FTN 4.5+410A       10/04/76  10.15.13        PAGE      9

FILE NAMES         MODE
    0  INPUT                   2041  OUTPUT                   4102  TAPE1                  20410  TAPE11
22451  TAPE12                  6143  TAPE2                   10204  TAPE3                  12245  TAPE4
    0  TAPE5       FMT         2041  TAPE6       FMT         14306  TAPE7                  16347  TAPE9

EXTERNALS            TYPE    ARGS
      AERO                     2                       BOUNDY                1
      EOF          REAL        1                       GAUSS                 4
      GEOM                     1                       INPUT                 0
      MATRX                    3                       PRESS                 2
      PRINT                    4                       SQRT        REAL      1 LIBRARY
      SURVEY                   4                       VECTOR                7

INLINE FUNCTIONS     TYPE    ARGS
      ABS          REAL        1  INTRIN

STATEMENT LABELS
24535  10                             24737  20       FMT                    24770  30       FMT
24774  40      FMT                    25000  50       FMT                    24560  60
    0  70                             25006  80       FMT                    24652  90
    0  100                            24660  110

LOOPS  LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
24561  100     *  IQ         267 299       76B                    EXT REFS    EXITS   NOT INNER
24605  90      *  IH         277 297       50B                    EXT REFS    EXITS   NOT INNER
24646  70         IRR        292 293        2B        INSTACK

COMMON BLOCKS    LENGTH
      / /            14
      SET1         2250
      SET2         6000
      SET3         8000
      SET4          840
      SET5          440
      SET6         2220
      SET7          240
      SET8          640
      SET9          200
      SET10         700
      SET11          20
      SET12           7
      SET13           6
      SET14           4
      SET15           5
      SET16        4000
      SET17         240
      SET18          27
      SET19         240
      SET20        6280

STATISTICS
  PROGRAM LENGTH                  24516B     10574
  BUFFER LENGTH                   24513B     10571
  CM LABELED COMMON LENGTH        77147B     32359
  CM BLANK COMMON LENGTH             16B        14
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      CONTROL*VRLX.AERO                                                 VORLAX   307
C...                                                                    VORLAX   308
      SUBROUTINE AERO (EW, ITOTAL)                                      VORLAX   309
C...                                                                    VORLAX   310
C...PURPOSE    TO COMPUTE FORCE AND MOMENT DATA BY INTEGRATION OF       VORLAX   311
C...           PRESSURE DISTRIBUTION DATA AND BY TAKING INTO ACCOUNT    VORLAX   312
C...           EDGE SUCTION FORCES.                                     VORLAX   313
C...                                                                    VORLAX   314
C...INPUT      CALLING SEQUENCES                                        VORLAX   315
C...           EW = NORMALWASH AT LEADING EDGE INFLUENCE COEFFICIENT    VORLAX   316
C...                MATRIX (RETRIEVED ROW BY ROW FROM UNIT 9).          VORLAX   317
C...           COMMONS                                                  VORLAX   318
C...           X, Y, Z, H2, DL, SX, YY, ZZ, DCP, JTS, LAX, PSI,         VORLAX   319
C...           SPC, VSS, VST, XTE, ALFA, MACH, NPAN, NVOR, SREF,        VORLAX   320
C...           VINF, XBAR, YAWQ, ZBAR, ZETA, CHORD, GAMMA, LESWP,       VORLAX   321
C...           PSPAN,, RNMAX, ROLLQ, SLOPE, TAPER, CSTART, IQUANT,      VORLAX   322
C...           LATRAL, NPANAS, PITCHQ.                                  VORLAX   323
C...                                                                    VORLAX   324
C...OUTPUT     CALLING SEQUENCES                                        VORLAX   325
C...           NONE.                                                    VORLAX   326
C...           COMMONS                                                  VORLAX   327
C...           CD, CL, CM, CN, CX, CY, FN, FY, RM, YM, CDC, CNC,        VORLAX   328
C...           CRM, CYM, CMTC, CSUC, DRAG, LIFT, SURF, XSUC,            VORLAX   329
C...           CDTOT, CLTOT, CMTOT, CNTOT, CXTOT, CYTOT, MOMENT,        VORLAX   330
C...                                                                    VORLAX   331
C...SUBROUTINES                                                         VORLAX   332
C...CALLED     NONE.                                                    VORLAX   333
C...                                                                    VORLAX   334
C...DISCUSSION SUBROUTINE AERO COMPUTES THE AERODYNAMIC FORCE AND       VORLAX   335
C...           MOMENT COEFFICIENTS BY INTEGRATING THE PRESSURE          VORLAX   336
C...           DISTRIBUTION AND COMPUTING THE LEADING EDGE SUCTION      VORLAX   337
C...           FORCES IN ACCORDANCE WITH LANES PROCEDURE. THERE ARE     VORLAX   338
C...           THREE CLASSES OF COEFFICIENTS, AS FOLLOWS S (1) TOTAL    VORLAX   339
C...           CONFIGURATION COEFFICIENTS, (2) PANEL COEFFICIENTS,      VORLAX   340
C...           AND (3) STRIPWISE, OR CHORDWISE, COEFFICIENTS. ALL       VORLAX   341
C...           TOTAL COEFFICIENTS ARE REFERENCED TO WIND AXES. CLASS    VORLAX   342
C...           (2) AND (3) COEFFICIENTS ARE REFERENCED EITHER TO BODY   VORLAX   343
C...           OR TO WIND AXES AS REQUIRED BY THE CORRESPONDING COEFF.  VORLAX   344
C...           DEFINITION. AERO SUBROUTINE IS CALLED BY MAIN FOR EVERY  VORLAX   345
C...           ANGLE OF ATTACK AND MACH NUMBER COMBINATION.             VORLAX   346
C                                                                       VORLAX   347
C                                                                       VORLAX   348
      DIMENSION EW (ITOTAL)                                             VORLAX   349
C                                                                       VORLAX   350
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,   VORLAX   351
     * FLOATX, FLOATY, INVERS                                           VORLAX   352
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                 VORLAX   353
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                VORLAX   354
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)     VORLAX   355
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),       VORLAX   356
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),    VORLAX   357
     * PSPAN (40), NVOR (40)                                            VORLAX   358
      COMMON /SET7 /RNCV (20), RNMAX (100), IIS (20), JTS (100)         VORLAX   359
      COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),         VORLAX   360
     * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),            VORLAX   361
     * RM (40), CRM (40), YM (40), CYM (40), XSUC (40), SURF (40)       VORLAX   362
      COMMON /SET9 /CDC (100), CNC (100)                                VORLAX   363
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),       VORLAX     364
     * TNT (100), ATE (100), IPAN (100)                                 VORLAX     365
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA     VORLAX     366
      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT     VORLAX     367
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                VORLAX     368
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                            VORLAX     369
      COMMON /SET15 /B2, BETA, CHAR, XBAR, ZBAR                         VORLAX     370
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                    VORLAX     371
      COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)                   VORLAX     372
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)        VORLAX     373
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),     VORLAX     374
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)            VORLAX     375
C                                                                       VORLAX     376
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                              VORLAX     377
      INTEGER CX, SX                                                    VORLAX     378
      PI = 3.14159                                                      VORLAX     379
      DTR = 0.01745329                                                  VORLAX     380
C                                                                       VORLAX     381
      PSIRAD = PSI *DTR                                                 VORLAX     382
      FLAX = LAX                                                        VORLAX     383
C                                                                       VORLAX     384
C...UNIT 9 CONTAINS THE LEADING EDGE NORMALWASH INFLUENCE COEFFICIENT   VORLAX     385
C...MATRIX AS COMPUTED IN SUBROUTINE MATRIX. MATRIX STORED BY ROWS.     VORLAX     386
C                                                                       VORLAX     387
      REWIND 9                                                          VORLAX     388
C                                                                       VORLAX     389
C...ALFA = ANGLE OF ATTACK IN RADIANS.                                  VORLAX     390
C...PSIRAD = ANGLE OF YAW IN RADIANS.                                   VORLAX     391
C                                                                       VORLAX     392
      SINALF = SIN (ALFA)                                               VORLAX     393
      COSALF = COS (ALFA)                                               VORLAX     394
      SINPSI = SIN (PSIRAD)                                             VORLAX     395
      COPSI = COS (PSIRAD)                                              VORLAX     396
      COSIN = COSALF *SINPSI *2.0                                       VORLAX     397
      COSINP = COSALF *SINPSI                                           VORLAX     398
      COSCOS = COSALF *COPSI                                            VORLAX     399
      PITCH = DTR *PITCHQ /VINF                                         VORLAX     400
      ROLL = DTR *ROLLQ /VINF                                           VORLAX     401
      YAW = DTR *YAWQ /VINF                                             VORLAX     402
C                                                                       VORLAX     403
C...LIFT = PANEL LIFT PER UNIT Q                                        VORLAX     404
C...DRAG = PANEL DRAG PER UNIT Q                                        VORLAX     405
C...XSUC = PANEL LEADING EDGE THRUST PER UNIT Q                         VORLAX     406
C...MOMENT = PANEL PITCHING MOMENT ABOUT REF. CENTER PER UNIT Q         VORLAX     407
C...FN = PANEL NORMAL FORCE PER UNIT Q                                  VORLAX     408
C...FY = PANEL SIDE FORCE PER UNIT Q                                    VORLAX     409
C...RM = PANEL ROLLING MOMENT PER UNIT Q                                VORLAX     410
C...YM = PANEL YAWING MOMENT PER UNIT Q                                 VORLAX     411
C...ALL ABOVE PANEL FORCES ARE REFERENCED TO WIND AXES EXCEPT FOR FN    VORLAX     412
C...WHICH IS IN BODY AXES.                                              VORLAX     413
C                                                                       VORLAX     414
C...INITIALIZE PANEL FORCE ARRAYS                                       VORLAX     415
C                                                                       VORLAX     416
      DO 10 IX = 1, NPANAS                                              VORLAX     417
      LIFT (IX) = 0.                                                    VORLAX     418
      DRAG (IX) = 0.                                                    VORLAX     419
      XSUC (IX) = 0.                                                    VORLAX     420
      MOMENT (IX) = 0.
      FN (IX) = 0.
      FY (IX) = 0.
      RM (IX) = 0.
      YM (IX) = 0.
 10   CONTINUE
C
C
C...HORSESHOE VORTEX STREAMWISE STRIPS ARE IDENTIFIED BY
C...A SPANWISE OR LATERAL INDEX, IR. EACH HORSESHOE VORTEX IS
C...IDENTIFIED BY AN ELEMENT INDEX, IRT. EACH MAJOR PANEL IS
C...IDENTIFIED BY AN INDEX (IR) WHICH GENERATES AN AUXILIARY INDEX (I).
C...WHEN I = IX THEN INPUT HALF OF CONFIGURATION IS BEING DEALT WITH.
C...WHEN I   IX THEN MIRRORED (ABOUT X-Z PLANE) COMPONENTS ARE BEING
C...CONSIDERED. I AND IX ARE DIFFERENT ONLY FOR ASYMMETRICAL
C...CONFIGURATIONS AND/OR FLIGHT CONDITIONS. ICYCLE IS AN AUXILIARY
C...INDEX  ICYCLE = 1 FOR IX = I; ICYCLE = 2 FOR IX .GT. I.
C...
C...
C...INITIALIZE INDICES<
C...
      IRT = 0
      IR = 0
      I = 1
      IX = 0
      ICYCLE = 1
 20   IX = IX + 1
C...
C...COMPUTE PANEL REFERENCE AREA, TANGENT OF LEADING EDGE SWEEP (TLE),
C...TANGENT OF TRAILING EDGE SWEEP (TTE), AND THE PRINCIPAL PART
C...PARAMETER (STB).
C...
      SURF (IX) = CSTART (I) *(1. + TAPER (I)) /2. *PSPAN (I)
      TEPAR = 2. *SURF (IX) /PSPAN (I) **2
      TEPAR = TEPAR *(1. - TAPER (I)) / (1. + TAPER (I))
      NV = NVOR (I)
      TLE = TAN (DTR *LESWP (I))
      TTE = TLE - TEPAR
      IF (ICYCLE .EQ. 2) TLE = - TLE
      IF (ICYCLE .EQ. 2) TTE = - TTE
      T2 = TLE **2
      STB = 0.0
      IF (B2 .LT. T2) STB = SQRT (T2 - B2)
C
C...THERE ARE NV STREAMWISE STRIPS OF HORSESHOE VORTICES FOR THE
C...PANEL (IX) UNDER CONSIDERATION. THE DO-LOOP ENDED BY LABEL 110
C...COMPUTES THE FORCE AND MOMENT CONTRIBUTION OF EACH STRIP AND
C...THEN PERFORMS THE CORRESPONDING SUMMATIONS TO OBTAIN THE
C...INTEGRATED PANEL FORCES AND MOMENTS (PER UNIT Q).
C...
      DO 110 J = 1, NV
      IR = IR + 1
C...
C...DL IS THE DIHEDRAL ANGLE (WITH RESPECT TO THE X-Y PLANE) OF
C...THE IR STREAMWISE STRIP OF HORSESHOE VORTICES.
C...
      SID = SIN (DTR *DL (IR))
      COD = COS (DTR *DL (IR))                                          VORLAX     478
C...                                                                    VORLAX     479
C...STRIPWISE PARAMETERS OR COEFFICIENTS<                               VORLAX     480
C...CNC = NORMAL (TO LOCAL CHORDLINE) FORCE COEFF. TIMES LOCAL          VORLAX     481
C...       CHORD LENGTH+                                                VORLAX     482
C...CDC = DRAG COEFF. (WIND AXES) TIMES LOCAL CHORD LENGTH+             VORLAX     483
C...CSUC = LEADING EDGE THRUST COEFF. MEASURED IN A PLANE               VORLAX     484
C...        PARALLEL TO THE X-X AXIS AND ALONG THE TANGENT              VORLAX     485
C...        TO THE CAMBER LINE IN SAME PLANE+                           VORLAX     486
C...CMTC = PITCHING MOMENT (BODY AXES) ABOUT LOCAL QUARTER CHORD        VORLAX     487
C...        TIMES LOCAL CHORD LENGTH+                                   VORLAX     488
C...                                                                    VORLAX     489
C...INITIALIZE COEFFICIENTS S                                           VORLAX     490
C...                                                                    VORLAX     491
C...                                                                    VORLAX     492
      CNC (IR) = 0.                                                     VORLAX     493
      CDC (IR) = 0.0                                                    VORLAX     494
      CSUC (IR) = 0.                                                    VORLAX     495
      CMTC (IR) = 0.0                                                   VORLAX     496
C                                                                       VORLAX     497
      MAX = RNMAX (IR)                                                  VORLAX     498
      PION = (PI *(1.0 - FLAX) + 2.0 *FLAX) /RNMAX (IR)                 VORLAX     499
      ADC = 0.5 *PION                                                   VORLAX     500
      IF (JTS (IR) .GT. 0) ADC = - 0.5 *PION                            VORLAX     501
C...                                                                    VORLAX     502
C...XLE = LOCATION OF FIRST VORTEX MIDPOINT IN FRACTION OF CHORD.       VORLAX     503
C...                                                                    VORLAX     504
      XLE=.5 *(1.0 - COS (.5 *PION)) *(1.0 - FLAX) + 0.125 *PION *FLAX  VORLAX     505
C...                                                                    VORLAX     506
C...BMLE = PITCHING MOMENT ABOUT FIRST VORTEX MIDPOINT IN BODY AXES.    VORLAX     507
C...CAXL = AXIAL (X-AXIS) FORCE COEFFICIENT.                            VORLAX     508
C...SICPLE = COUPLE (ABOUT STRIP CENTERLINE) DUE TO SIDESLIP.           VORLAX     509
C...                                                                    VORLAX     510
      BMLE = 0.                                                         VORLAX     511
      CAXL = 0.0                                                        VORLAX     512
      SICPLE = 0.0                                                      VORLAX     513
C                                                                       VORLAX     514
      RJTS = JTS (IR)                                                   VORLAX     515
      GAF = 0.5 + 0.5 *RJTS **2                                         VORLAX     516
C                                                                       VORLAX     517
C...THE DO-LOOP ENDED BY LABEL 60 PERFORMS PRESSURE COEFF.              VORLAX     518
C...INTGRATIONS ALONG THE STRIP TO OBTAIN CNC (PRESENTLY TREATED        VORLAX     519
C...AS CN), CAXL, BMLE, AND SICPLE.                                     VORLAX     520
C...                                                                    VORLAX     521
C                                                                       VORLAX     522
      DO 60 K = 1, MAX                                                  VORLAX     523
      IRT = IRT + 1                                                     VORLAX     524
      RK = K                                                            VORLAX     525
C...                                                                    VORLAX     526
C...CORMED IS LENGTH OF STRIP CENTERLINE BETWEEN LOAD POINT             VORLAX     527
C...AND TRAILING EDGE+ THIS PARAMETER IS USED IN THE COMPUTATION        VORLAX     528
C...OF THE STRIP ROLLING COUPLE CONTRIBUTION DUE TO SIDESLIP.           VORLAX     529
C...                                                                    VORLAX     530
      CORMED = XTE (IR) - X (IRT)                                       VORLAX     531
C...                                                                    VORLAX     532
C...SINF REFERENCES THE LOAD CONTRIBUTION OF IRT-VORTEX TO THE          VORLAX     533
C...STRIP NOMINAL AREA, I.E., AREA OF STRIP ASSUMING CONSTANT           VORLAX     534
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C...(CHORDWISE) HORSESHOE SPAN.                                         VORLAX     535
C...                                                                    VORLAX     536
      SINF = (FLAX + (1.0 - FLAX) *SIN ((RK - .5) *PION)) *ADC          VORLAX     537
     * *DCP (IRT) *VST (IRT) /VSS (IR)                                  VORLAX     538
      CNC (IR) = CNC (IR) + SINF                                        VORLAX     539
      SICPLE = SICPLE + SINF *CURMED                                    VORLAX     540
C...                                                                    VORLAX     541
C...COMPUTE SLOPE (TX) WITH RESPECT TO X-AXIS AT LOAD POINTS BY INTER    VORLAX     542
C...POLATING BETWEEN CONTROL POINTS AND TAKING INTO ACCOUNT THE LOCAL    VORLAX     543
C...INCIDENCE.                                                          VORLAX     544
C...                                                                    VORLAX     545
      XX = .5 *(1. - COS ((RK - .5) *PION))                             VORLAX     546
      XX = XX *(1.0 - FLAX) + (RK - .75) *PION /2.0 *FLAX               VORLAX     547
      IF (K .GT.1) GO TO 30                                             VORLAX     548
      KX = K                                                            VORLAX     549
      IRTX = IRT                                                        VORLAX     550
      GO TO 40                                                          VORLAX     551
   30 KX = K - 1                                                        VORLAX     552
      IRTX = IRT - 1                                                    VORLAX     553
   40 RKX = KX                                                          VORLAX     554
      X1 = .5 *(1. - COS (RKX *PION))                                   VORLAX     555
      X1 = X1 *(1.0 - FLAX) + (RKX - .25) *PION /2.0 *FLAX              VORLAX     556
      X2 = .5 *(1. - COS ((RKX + 1.) *PION))                            VORLAX     557
      X2 = X2 *(1.0 - FLAX) + (RKX + .75) *PION /2.0 *FLAX              VORLAX     558
      F1 = SLOPE (IRTX)                                                 VORLAX     559
      F2 = SLOPE (IRTX + 1)                                             VORLAX     560
      TANX = (XX - X2) /(X1 - X2) *F1 + (XX - X1) /(X2 - X1) *F2        VORLAX     561
      TX = TANX - ZETA (IR)                                             VORLAX     562
      CAXL = CAXL - SINF *TX /(1.0 + TX **2)                            VORLAX     563
   50 BMLE = BMLE + (XLE - XX) *SINF                                    VORLAX     564
   60 CONTINUE                                                          VORLAX     565
C                                                                       VORLAX     566
      SICPLE = - SICPLE *COSIN *COD *GAF                                VORLAX     567
C                                                                       VORLAX     568
C...                                                                    VORLAX     569
C...IRTLE = VALUE OF IRT INDEX FOR FIRST (ALONG CHORD) HORSESHOE         VORLAX     570
C...VORTEX, I.E., LEADING EDGE ELEMENT.                                 VORLAX     571
C...                                                                    VORLAX     572
      IRTLE = IRT - MAX + 1                                             VORLAX     573
C...                                                                    VORLAX     574
C...                                                                    VORLAX     575
C...COMPUTE LEADING EDGE THRUST COEFF. (CSUC) BY CALCULATING            VORLAX     576
C...THE TOTAL INDUCED FLOW AT THE LEADING EDGE. THIS COMPUTATION        VORLAX     577
C...ONLY PERFORMED FOR COSINE CHORDWISE SPACING (LAX = 0).              VORLAX     578
C...                                                                    VORLAX     579
C...                                                                    VORLAX     580
      CLE = 0.0                                                         VORLAX     581
      IF (LAX .EQ. 1) GO TO 90                                          VORLAX     582
C                                                                       VORLAX     583
      READ (9) EW                                                       VORLAX     584
C                                                                       VORLAX     585
      DO 70 II = 1, ITOTAL                                              VORLAX     586
      CLE = CLE + EW (II) *GAMMA (II)                                   VORLAX     587
   70 CONTINUE                                                          VORLAX     588
C                                                                       VORLAX     589
C...XGIRO, YGIRO, ZGIRO ARE THE COORDINATES OF THE STRIP LEADING EDGE   VORLAX     590
C...MIDPOINT WITH RESPECT TO THE POINT OF AIRCRAFT ROTATION (IF ANY).   VORLAX     591
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      C...                                                                VORLAX    592
            XGIRO = X (IRTLE) - CHORD (IR) *XLE - XBAR                    VORLAX    593
            YGIRO = YY (IRTLE)                                            VORLAX    594
            ZGIRO = ZZ (IRTLE) - ZBAR                                     VORLAX    595
      C...                                                                VORLAX    596
      C...VX, VY, VZ ARE THE FLOW ONSET VELOCITY COMPONENTS AT THE LEADING VORLAX    597
      C...EDGE (STRIP MIDPOINT). VX, VY, VZ AND THE ROTATION RATES ARE    VORLAX    598
      C...REFERENCED TO THE FREE STREAM VELOCITY.                         VORLAX    599
      C...                                                                VORLAX    600
            VX = COSCOS - PITCH *ZGIRO + YAW *YGIRO                       VORLAX    601
            VY = COSINP - YAW *XGIRO + ROLL *ZGIRO                        VORLAX    602
            VZ = SINALF - ROLL *YGIRO + PITCH *XGIRO                      VORLAX    603
      C...                                                                VORLAX    604
      C...CCNTL AND SCNTL ARE DIRECTION COSINE PARAMETERS OF TANGENT TO   VORLAX    605
      C...CAMBERLINE AT LEADING EDGE.                                     VORLAX    606
      C...                                                                VORLAX    607
            CCNTL = 1. /SQRT (1.0 + SLE (IR) **2)                         VORLAX    608
            SCNTL = SLE (IR) *CCNTL                                       VORLAX    609
      C...                                                                VORLAX    610
      C...EFFINC = COMPONENT OF ONSET FLOW ALONG NORMAL TO CAMBERLINE AT  VORLAX    611
      C...            LEADING EDGE.                                       VORLAX    612
      C...                                                                VORLAX    613
            EFFINC = VX *SCNTL + VY *CCNTL *SIN - VZ *CCNTL *COD          VORLAX    614
            CLE = CLE - EFFINC                                            VORLAX    615
       80   IF (STH .GT. 0.0) CLE = CLE /RNMAX (IR) /STH                  VORLAX    616
       90   XA = XLE                                                      VORLAX    617
            CLE = CLE + 0.5 *DCP (IRTLE) *SQRT (XA) *FLAX                 VORLAX    618
            CSUC (IR) = 0.5 *PI *ABS (SPC (I)) *CLE **2 *STH              VORLAX    619
      C...                                                                VORLAX    620
      C...END OF L.E. THRUST COEFF. (CSUC) COMPUTATION FOR STRIP IR.      VORLAX    621
      C...                                                                VORLAX    622
      C...                                                                VORLAX    623
      C...ORIENT L.E. THRUST VECTOR ACCORDING TO SIGN OF SPC PARAMETERS   VORLAX    624
      C...IF SPC $ 0 THEN L.E. THRUST VECTOR IS TANGENTIAL TO CAMBER      VORLAX    625
      C...SURFACE, OTHERWISE IT IS NORMAL TO IT. IF THE FIRST ELEMENT     VORLAX    626
      C...CARRIES A POSITIVE LOAD THEN THE THRUST VECTOR IS NORMAL TO THE VORLAX    627
      C...CAMBER SURFACE ALONG THE POSITIVE NORMAL DIRECTION, OTHERWISE   VORLAX    628
      C...IT IS ALONG THE NEGATIVE NORMAL (THE PARAMETER FKEY DETER-      VORLAX    629
      C...-MINES THIS DIRECTION ; FKEY = + 1, POSITIVE NORMAL,            VORLAX    630
      C...FKEY = - 1, NEGATIVE NORMAL).                                   VORLAX    631
      C...TFX AND TFZ ARE THE COMPONENTS OF LEADING EDGE FORCE VECTOR ALONG VORLAX    632
      C...ALONG THE X AND Z BODY AXES.                                    VORLAX    633
      C...                                                                VORLAX    634
            FKEY = 1 - JTS (IR) *(1 + JTS (IR))                           VORLAX    635
            XCOS = 1.0 /SQRT (1.0 + (SLE (IR) - ZETA (IR)) **2)           VORLAX    636
            XSIN = (SLE (IR) - ZETA (IR)) *XCOS                           VORLAX    637
            TFX = XCOS                                                    VORLAX    638
            IF (SPC (I) .LT.  .0 ) TFX = XSIN *SIGN (1.0, DCP (IRTLE)) *FKEY VORLAX    639
            CAXL = CAXL - TFX *CSUC (IR)                                  VORLAX    640
            TFZ = - XSIN                                                  VORLAX    641
            IF (SPC (I) .LT. 0.0) TFZ = SIGN (XCOS, DCP(IRTLE)) *FKEY     VORLAX    642
            CNC (IR) = CNC (IR) + CSUC (IR) *SQRT (1.0 + T2) *TFZ         VORLAX    643
      C...                                                                VORLAX    644
      C...FCOS AND FSIN ARE THE COSINE AND SINE OF THE ANGLE BETWEEN      VORLAX    645
      C...THE CHORDLINE OF THE IR-STRIP AND THE X-AXIS                    VORLAX    646
      C...                                                                VORLAX    647
      100   FCOS = 1. /SQRT (1. + ZETA (IR) *ZETA (IR))                   VORLAX    648
      FSIN = FCOS *ZETA (IR)
C...
C...BFX, BFY, AND BFZ ARE THE COMPONENTS ALONG THE BODY AXES
C...OF THE STRIP FORCE CONTRIBUTION.
C...
      BFX = - CNC (IR) *FSIN + CAXL *FCOS
      BFY = - (CNC (IR) *FCOS + CAXL *FSIN) *SID
      BFZ = (CNC (IR) *FCOS + CAXL *FSIN) *COD
C...
C...CONVERT CNC FROM CN INTO CNC (COEFF. *CHORD).
C...
      CNC (IR) = CNC (IR) *CHORD (IR)
      BMLE = BMLE *CHORD (IR)
C...
C...BMX, BMY, AND BMZ ARE THE COMPONENTS ALONG THE BODY AXES
C...OF THE STRIP MOMENT (ABOUT MOM. REF. POINT) CONTRIBUTION.
C...
      BMX = BFZ *Y (IR) - BFY *(Z (IR) - ZBAR)
      BMX = BMX + SICPLE
      BMY = BMLE *COD + BFX * (Z (IR) - ZBAR) - BFZ * (X (IRTLE) -XBAR)
      BMZ = BMLE *SID - BFX *Y (IR) + BFY * (X (IRTLE) - XBAR)
      CDC (IR) = BFZ *SINALF +  (BFX *COPSI + BFY *SINPSI) *COSALF
      CDC (IR) = CDC (IR) *CHORD (IR)
      CMTC (IR) = BMLE + CNC (IR) * (0.25 - XLE)
C
      ES = 2.0 *VSS (IR)
      STRIP = ES *CHORD (IR)
      LIFT (IX) = (BFZ *COSALF - (BFX *COPSI + BFY *SINPSI) *SINALF)
     + *STRIP + LIFT (IX)
      DRAG (IX) = CDC (IR) *ES + DRAG (IX)
      FY (IX) = (BFY *COPSI - BFX *SINPSI) *STRIP + FY (IX)
C
      FN (IX) = FN (IX) + CNC (IR) *ES
C
      MOMENT (IX) = MOMENT (IX) + STRIP *(BMY *COPSI - BMX *SINPSI)
      RM (IX) = RM (IX) + STRIP *(BMX *COSALF *COPSI + BMY *COSALF
     + *SINPSI + BMZ *SINALF)
      YM (IX) = YM (IX) + STRIP *(BMZ *COSALF - (BMX *COPSI + BMY
     + *SINPSI) *SINALF)
      XSUC (IX) = XSUC (IX) + CSUC (IR) *STRIP /SURF (IX)
C
  110 CONTINUE
C
C
      IF (ICYCLE .EQ. 2) GO TO 130
      I = I + 1
      IF (I - NPAN) 20, 20, 120
  120 IF (LATRAL .EQ. 0) GO TO 140
      ICYCLE = 2
      I = 0
  130 I = I + 1
      IF (I .GT. NPAN) GO TO 140
      IF (IQUANT (I) .EQ. 1) GO TO 130
      GO TO 20
C
C...INITIALIZE TOTAL FORCE AND MOMENT COEFFICIENTS.
C
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          140  CLTOT = 0.                                                        VORLAX     706
               CDTOT = 0.0                                                       VORLAX     707
               CMTOT = 0.0                                                       VORLAX     708
               CYTOT = 0.0                                                       VORLAX     709
               CRTOT = 0.0                                                       VORLAX     710
               CNTOT = 0.0                                                       VORLAX     711
         C...                                                                    VORLAX     712
         C...THE PARAMETERS AX AND AY INTRODUCE THE PROPER REFERENCE AREA        VORLAX     713
         C...AND DETERMINE WHETHER A PANEL CONTRIBUTION HAS TO BE DUPLICA        VORLAX     714
         C...TED (SYMMETRICAL CASE) OR NOT.                                      VORLAX     715
         C...                                                                    VORLAX     716
               AX = 1.0 /SREF                                                    VORLAX     717
               IF (LATRAL .EQ. 0) AX = 2.0 *AX                                   VORLAX     718
               AY = 1.0 /SREF                                                    VORLAX     719
               IF (LATRAL .EQ. 0) AY = 0.0                                       VORLAX     720
         C                                                                       VORLAX     721
         C...THE DO-LOOP ENDED BY LABEL 150 COMPUTES PANEL AND TOTAL             VORLAX     722
         C...FORCE AND MOMENT COEFFICIENTS. MOMENT COEFFICIENTS ARE NOT          VORLAX     723
         C...DIMENSIONLESS YET, THEY STILL CARRY A LENGTH DIMENSION.             VORLAX     724
         C...                                                                    VORLAX     725
               DO 150 IX = 1, NPANAS                                             VORLAX     726
               CL (IX) = LIFT (IX) /SURF (IX)                                    VORLAX     727
               CD (IX) = DRAG (IX) /SURF (IX)                                    VORLAX     728
               CM (IX) = MOMENT (IX) /SURF (IX)                                  VORLAX     729
               CN (IX) = FN (IX) /SURF (IX)                                      VORLAX     730
               CY (IX) = FY (IX) /SURF (IX)                                      VORLAX     731
               CRM (IX) = RM (IX) /SURF (IX)                                     VORLAX     732
               CYM (IX) = YM (IX) /SURF (IX)                                     VORLAX     733
               CLTOT = CLTOT + LIFT (IX) *AX                                     VORLAX     734
               CDTOT = CDTOT + DRAG (IX) *AX                                     VORLAX     735
               CMTOT = CMTOT + MOMENT (IX) *AX                                   VORLAX     736
               CYTOT = CYTOT + FY (IX) *AY                                       VORLAX     737
               CRTOT = CRTOT + RM (IX) *AY                                       VORLAX     738
               CNTOT = CNTOT + YM (IX) *AY                                       VORLAX     739
          150  CONTINUE                                                          VORLAX     740
         C                                                                       VORLAX     741
               REWIND 9                                                          VORLAX     742
         C                                                                       VORLAX     743
         C                                                                       VORLAX     744
               RETURN                                                            VORLAX     745
               END                                                               VORLAX     746
```

```
   SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
   3  AERO

VARIABLES     SN  TYPE              RELOCATION
  732  ADC        REAL                                   20  ALFA       REAL                 SET11
   10  ALPHA      REAL       ARRAY     SET11           1012  AX         REAL
 1013  AY         REAL                                    1  BETA       REAL                 SET15
 1002  BFX        REAL                                 1003  BFY        REAL
 1004  BFZ        REAL                                    0  BIG        REAL                 SET13
```

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       SUBROUTINE AERO        74/74    OPT=1                                      FTN 4.5+410       10/04/76  10.15.13        PAGE      9

VARIABLES      SN  TYPE            RELOCATION
   734  AMLE       REAL                                     1005  AMX        REAL
  1006  AMY        REAL                                     1007  AMZ        REAL
     0  B2         REAL                  SET15               735  CAXL       REAL
     2  CBAR       REAL                  SET15               770  CCNTL      REAL
   240  CD         REAL        ARRAY     SET8                  0  CDC        REAL         ARRAY     SET9
     1  CDTOT      REAL                  SET12                 0  CHORD      REAL         ARRAY     SET10
   170  CL         REAL        ARRAY     SET8                760  CLE        REAL
     0  CLTOT      REAL                  SET12               310  CM         REAL         ARRAY     SET8
   144  CMTC       REAL        ARRAY     SET17                 2  CMTOT      REAL                   SET12
   430  CN         REAL        ARRAY     SET8                144  CNC        REAL         ARRAY     SET9
     6  CNTOT      REAL                  SET12               727  COD        REAL
   703  COPSI      REAL                                      743  CORMEU     REAL
   701  COSALF     REAL                                      706  COSCOS     REAL
   704  COSIN      REAL                                      705  COSINP     REAL
   670  CRM        REAL        ARRAY     SET8                  5  CRTOT      REAL                   SET12
   430  CSTART     REAL        ARRAY     SET5                  0  CSUC       REAL         ARRAY     SET17
     0  CX         INTEGER     ARRAY     SET3                550  CY         REAL         ARRAY     SET8
  1010  CYM        REAL        ARRAY     SET8                  4  CYTOT      REAL                   SET12
     0  DCP        REAL        ARRAY     SET2                144  DL         REAL         ARRAY     SET10
    50  DRAG       REAL        ARRAY     SET8                675  DTR        REAL
   772  EFFINC     REAL                                        3  EPS        REAL                   SET13
  1010  ES         REAL                                        0  EW         REAL         ARRAY      F.P.
  1000  FCOS       REAL                                      773  FKEY       REAL
   677  FLAX       REAL                                       12  FLOATX     REAL                   / /
    13  FLOATY     REAL                  / /                 360  FN         REAL         ARRAY     SET8
  1001  FSIN       REAL                                      500  FY         REAL         ARRAY     SET8
   753  F1         REAL                                      754  F2         REAL
   740  GAF        REAL                                        0  GAMMA      REAL         ARRAY     SET16
    11  HAG        REAL                  / /                 715  I          INTEGER
   716  ICYCLE     INTEGER                                 13560  IDFS       INTEGER      ARRAY     SET3
     3  IH         INTEGER               / /                 761  II         INTEGER
   404  INTRAC     INTEGER     ARRAY     SET20                14  INVERS     INTEGER                / /
  1130  IPAN       INTEGER     ARRAY     SET10                 2  IQ         INTEGER                / /
   360  IQUANT     INTEGER     ARRAY     SET5                714  IR         INTEGER
   713  IRT        INTEGER                                   757  IRTLE      INTEGER
   747  IRTX       INTEGER                                     1  ITER       INTEGER                SET13
     0  ITOTAL     INTEGER                F.P.                 2  ITRMAX     INTEGER                SET13
   170  ITS        INTEGER     ARRAY     SET7                712  IX         INTEGER
   725  J          INTEGER                                   214  JTS        INTEGER      ARRAY     SET7
   741  K          INTEGER                                   746  KX         INTEGER
     4  LATRAL     INTEGER               / /                   0  LAX        INTEGER                / /
     1  LAY        INTEGER               / /                 240  LESWP      REAL         ARRAY     SET5
     0  LIFT       REAL        ARRAY     SET8                  0  MACH       REAL         ARRAY     SET11
   730  MAX        INTEGER                                   120  MOMENT     REAL         ARRAY     SET8
    23  NALPHA     INTEGER               SET11                22  NMACH      INTEGER                SET11
     0  NPAN       INTEGER               SET14                 3  NPANAS     INTEGER                SET14
   360  NPP        INTEGER     ARRAY     SET20                 1  NT         INTEGER                SET14
   720  NV         INTEGER                                   620  NVOR       REAL         ARRAY     SET5
  3720  ONSET      REAL        ARRAY     SET[illegible]      170  PDL        REAL         ARRAY     SET5
    50  PHIMED     REAL        ARRAY     [illegible]         674  PI         REAL
   731  PION       REAL                                      707  PITCH      REAL
     6  PITCHQ     REAL                  / /                   5  PSI        REAL                   / /
   676  PSIRAD     REAL                                      550  PSPAN      REAL         ARRAY     SET5
   214  RCS        REAL        ARRAY     SET20              7640  RFLAG      REAL         ARRAY     SET3
   737  RJTS       REAL                                      742  RK         REAL
   750  RKX        REAL                                        5  RLM        REAL                   SET13
   620  RM         REAL        ARRAY     SET8                  0  RNCV       REAL         ARRAY     SET7
```

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VARIABLES       SN  TYPE             RELOCATION
    24  RNMAX       REAL       ARRAY     SET7             710  ROLL        REAL
     7  ROLLQ       REAL                 / /              771  SCNTL       REAL
   736  SICPLE      REAL                                  726  SID         REAL
   700  SINALF      REAL                                  744  SINF        REAL
   702  SINPSI      REAL                                   50  SLE         REAL         ARRAY     SET19
     0  SLE1        REAL       ARRAY     SET19             24  SLE2        REAL         ARRAY     SET19
  3720  SLOPE       REAL       ARRAY     SET2               2  SMAX        REAL                   SET14
   310  SPC         REAL       ARRAY     SET17              3  SREF        REAL                   SET12
   724  STB         REAL                                 1011  STRIP       REAL
  1130  SURF        REAL       ARRAY     SET8            3720  SX          INTEGER      ARRAY     SET3
   310  SYNTH       REAL       ARRAY     SET5             755  TANK        REAL
   500  TAPER       REAL       ARRAY     SET5             717  TEPAR       REAL
   776  TFX         REAL                                  777  TFZ         REAL
   721  TLE         REAL                                  454  TNL         REAL         ARRAY     SET10
   620  TNT         REAL       ARRAY     SET10            722  TTE         REAL
   756  TX          REAL                                  723  T2          REAL
    21  VINF        REAL                 SET11           7640  VSP         REAL         ARRAY     SET2
   310  VSS         REAL       ARRAY     SET10          10270  VST         REAL         ARRAY     SET20
   765  VX          REAL                                  766  VY          REAL
   767  VZ          REAL                                    4  WSPAN       REAL                   SET13
     0  X           REAL       ARRAY     SET1               0  XAPEX       REAL         ARRAY     SET5
     3  XBAR        REAL                 SET15            774  XCOS        REAL
   762  XGIRO       REAL                                  733  XLE         REAL
   775  XSIN        REAL                                 1060  XSUC        REAL         ARRAY     SET8
   764  XTE         REAL       ARRAY     SET10            745  XX          REAL
   751  X1          REAL                                  752  X2          REAL
  3720  Y           REAL       ARRAY     SET1              50  YAPEX       REAL         ARRAY     SET5
   711  YAW         REAL                                   10  YAWQ        REAL                   / /
   763  YGIRO       REAL                                  740  YM          REAL         ARRAY     SET8
   430  YY          REAL       ARRAY     SET20           4064  Z           REAL         ARRAY     SET1
   120  ZAPEX       REAL       ARRAY     SET5               4  ZBAR        REAL                   SET15
  4230  ZC          REAL       ARRAY     SET1             214  ZETA        REAL         ARRAY     SET19
   764  ZGIRO       REAL                                    0  ZLE1        REAL         ARRAY     SET20
    24  ZLE2        REAL       ARRAY     SET20           4350  ZZ          REAL         ARRAY     SET20

FILE NAMES          MODE
        TAPE9       UNFMT

EXTERNALS             TYPE    ARGS
        COS         REAL        1 LIBRARY                     SIN         REAL         1 LIBRARY
        SQRT        REAL        1 LIBRARY                     TAN         REAL         1 LIBRARY

INLINE FUNCTIONS      TYPE    ARGS
        ABS         REAL        1  INTRIN                     SIGN        REAL         2  INTRIN

STATEMENT LABELS
     0  10                                  62  20                                   221  30
   225  40                                   0  50        INACTIVE                     0  60
     0  70                                   0  80        INACTIVE                   364  90
     0  100          INACTIVE                0  110                                    0  120        INACTIVE
   572  130                                577  140                                    0  150

LOOPS  LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
   50  10           IX        111 120        6B       INSTACK
  116  110      *  J          165 384      445B                      EXT REFS  NOT INNER
  157  60       *  K          217 259      115B                      EXT REFS
  314  70           II        280 282        4B       INSTACK
```

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LOOPS  LABEL    INDEX      FROM-TO    LENGTH    PROPERTIES
  615  150      IX         420 434       33B       OPT

COMMON BLOCKS   LENGTH
       / /          13
       SET1       2250
       SET2       6000
       SET3       8000
       SET5        440
       SET7        240
       SET8        640
       SET9        200
       SET10       700
       SET11        20
       SET12         7
       SET13         6
       SET14         4
       SET15         5
       SET16      4000
       SET17       240
       SET19       240
       SET20      6280

STATISTICS
  PROGRAM LENGTH                  1022B      530
  CM LABELED COMMON LENGTH       71130B    29272
  CM BLANK COMMON LENGTH           15B        13
```

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CONTROL*VRLX.BOUNDY                                            9/17/76  VORLAX     747
C...                                                                    VORLAX     748
      SUBROUTINE BOUNDY (ITOTAL)                                        VORLAX     749
C...                                                                    VORLAX     750
C...PURPOSE     TO CALCULATE THE ONSET FLOW COMPONENT NORMAL TO         VORLAX     751
C...            THE BOUNDARY SURFACE AT THE VORTEX LATTICE CON          VORLAX     752
C...            TROL POINTS.                                            VORLAX     753
C...                                                                    VORLAX     754
C...INPUT       CALLING SEQUENCE <                                      VORLAX     755
C...            ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.            VORLAX     756
C...            COMMON <                                                VORLAX     757
C...            ALFA, PSI, VINF, PITCHQ, ROLLQ, YAWQ, LAX, RNMAX,       VORLAX     758
C...            SX, CX, X, YY, ZZ, DL, CHORD, XBAR, ZBAR, SLOPE,        VORLAX     759
C...            RFLAG.                                                  VORLAX     760
C...                                                                    VORLAX     761
C...OUTPUT      COMMON <                                                VORLAX     762
C...            ALOC, ONSET.                                            VORLAX     763
C...                                                                    VORLAX     764
C...SUBROUTINES                                                         VORLAX     765
C...CALLED      NONE.                                                   VORLAX     766
C...                                                                    VORLAX     767
C...DISCUSSION THE ONSET FLOW COMPONENT NORMAL TO THE BOUNDARY          VORLAX     768
C...            AT THE VORTEX LATTICE CONTROL POINTS IS CALCULATED      VORLAX     769
C...            BY PROJECTING THE FREE-STREAM VELOCITY VECTOR           VORLAX     770
C...            ALONG THE SURFACE NORMAL AND TAKING INTO ACCOUNT        VORLAX     771
C...            A RIGID BODY ROTATION ABOUT THE POINT (XBAR, 0,         VORLAX     772
C...            ZBAR). THE ONSET FLOW NORMAL COMPMONENT IS ALOC.        VORLAX     773
C...            ONSET DENOTES THE RIGID BODY ROTATION INDUCED           VORLAX     774
C...            VELOCITY COMPONENT ALONG THE X-AXIS. BOTH ARRAY         VORLAX     775
C...            ALOC AND ONSET, ARE DIMENSIONLESS, I.E., THEY ARE       VORLAX     776
C...            REFERENCED TO THE FREE-STREAM VELOCITY.                 VORLAX     777
C...                                                                    VORLAX     778
C...                                                                    VORLAX     779
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, HAG,   VORLAX     780
     * FLOATX, FLOATY, INVERS                                           VORLAX     781
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                 VORLAX     782
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                VORLAX     783
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)     VORLAX     784
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                 VORLAX     785
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)         VORLAX     786
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),       VORLAX     787
     * TNT (100), XTE (100), IPAN (100)                                 VORLAX     788
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA     VORLAX     789
      COMMON /SET13 /RIG, ITER, ITRMAX, EPS , WSPAN, RLM                VORLAX     790
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                         VORLAX     791
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                    VORLAX     792
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),     VORLAX     793
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)            VORLAX     794
      INTEGER CX, SX                                                    VORLAX     795
C                                                                       VORLAX     796
      PI = 3.14159                                                      VORLAX     797
      DTR = 0.01745329                                                  VORLAX     798
      PITCH = DTR *PITCHQ /VINF                                         VORLAX     799
      ROLL = DTR *ROLLQ /VINF                                           VORLAX     800
      YAW = DTR *YAWQ /VINF                                             VORLAX     801
      PSIRAD = DTR *PSI                                                 VORLAX     802
      SINALF = SIN (ALFA)                                               VORLAX     803
      COSIN = COS (ALFA) *SIN (PSIRAD)                                  VORLAX    804
      COSCOS = COS (ALFA) *COS (PSIRAD)                                 VORLAX    805
      FLAX = LAX                                                        VORLAX    806
C                                                                       VORLAX    807
      DO 10 IR = 1, ITOTAL                                              VORLAX    808
C...                                                                    VORLAX    809
C...LOCATE VORTEX LATTICE CONTROL POINT WITH RESPECT TO THE             VORLAX    810
C...ROTATION CENTER (XBAR, 0, ZBAR). THE RELATIVE COORDINATES           VORLAX    811
C...ARE XGIRO, YGIRO, AND ZGIRO.                                        VORLAX    812
C...                                                                    VORLAX    813
      PION = PI /RNMAX (SX (IR))                                        VORLAX    814
      RCX = CX (IR)                                                     VORLAX    815
      RSX = SX (IR)                                                     VORLAX    816
      DELTAX = 0.5 * (COS ((RCX - .5) *PION) - COS (RCX *PION))         VORLAX    817
      DELTAX = DELTAX *(1. - FLAX) + 0.5/RNMAX (SX (IR)) *FLAX          VORLAX    818
      XGIRO = X (IR) + CHORD (SX (IR)) *DELTAX - XBAR                   VORLAX    819
      YGIRO = YY (IR)                                                   VORLAX    820
      ZGIRO = ZZ (IR) - ZBAR                                            VORLAX    821
C                                                                       VORLAX    822
C...COMPUTE ONSET FLOW (FREE-STREAM + RIGID BODY ROTATION)              VORLAX    823
C...VELOCITY COMPONENTS ALONG BODY AXES, VX, VY, AND VZ.                VORLAX    824
C...                                                                    VORLAX    825
      VX = COSCOS - PITCH *ZGIRO + YAW *YGIRO                           VORLAX    826
      VY = COSIN - YAW *XGIRO + ROLL *ZGIRO                             VORLAX    827
      VZ = SINALF - ROLL *YGIRO + PITCH *XGIRO                          VORLAX    828
C                                                                       VORLAX    829
C...COMPUTE DIRECTION COSINES.                                          VORLAX    830
C                                                                       VORLAX    831
      SCNTL = SLOPE (IR) /SQRT (1. + SLOPE (IR) **2)                    VORLAX    832
      CCNTL = SQRT (1.0 - SCNTL **2)                                    VORLAX    833
      COD = COS (DTR *DL (SX (IR)))                                     VORLAX    834
      SID = SIN (DTR *DL (SX (IR)))                                     VORLAX    835
C                                                                       VORLAX    836
C...COMPUTE ONSET FLOW COMPONENT ALONG THE OUTWARD NORMAL TO            VORLAX    837
C...THE SURFACE AT THE CONTROL POINT, ALOC.                             VORLAX    838
C...                                                                    VORLAX    839
      ALOC (IR) = VX *SCNTL + VY *CCNTL *SID - VZ *CCNTL *COD           VORLAX    840
C...                                                                    VORLAX    841
C...THE VALUE OF RFLAG (0. OR 1.) DETERMINES WHETHER THE HORSE          VORLAX    842
C...SHOE VORTEX IS SONIC (RFLAG = 0.) OR NOT (RFLAG = 1.). FOR          VORLAX    843
C...A SONIC VORTEX THE BOUNDARY CONDITION EQUATION IS REPLACED          VORLAX    844
C...BY AN AVERAGING PROCESS AND THERFFORE THE VALUE OF ALOC HAS         VORLAX    845
C...TO BE ZEROED OUT.                                                   VORLAX    846
C...                                                                    VORLAX    847
      ALOC (IR) = ALOC (IR) *RFLAG (IR)                                 VORLAX    848
C...                                                                    VORLAX    849
C...COMPUTE VELOCITY COMPONENT ALONG X-AXIS INDUCED BY THE RIGID         VORLAX    850
C...BODY ROTATION, ONSET.                                               VORLAX    851
C...                                                                    VORLAX    852
      ONSET (IR) = - PITCH *ZGIRO + YAW *YGIRO                          VORLAX    853
   10 CONTINUE                                                          VORLAX    854
C                                                                       VORLAX    855
C                                                                       VORLAX    856
      RETURN                                                            VORLAX    857
      END                                                               VORLAX    858
      SUBROUTINE BOUNDY      74/74    OPT=1                              FTN 4.5+410A        10/04/76  10.15.13        PAGE       3

      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  BOUNDY

VARIABLES      SN  TYPE            RELOCATION
    20  ALFA       REAL                 SET11             334  ALOC      REAL          ARRAY      SET6
    10  ALPHA      REAL       ARRAY     SET11               1  BETA      REAL                     SET15
     0  BIG        REAL                 SET13               0  B2        REAL                     SET15
     2  CBAR       REAL                 SET15             177  CCNTL     REAL
     0  CHORD      REAL       ARRAY     SET10             200  COD       REAL
   161  COSCOS     REAL                                   160  COSIN     REAL
     0  CX         INTEGER    ARRAY     SET3                0  DCP       REAL          ARRAY      SET2
   167  DELTAX     REAL                                   144  DL        REAL          ARRAY      SET10
   152  DTR        REAL                                     3  EPS       REAL                     SET13
   162  FLAX       REAL                                    12  FLOATX    REAL                     / /
    13  FLOATY     REAL                 / /                 0  GAMMA     REAL          ARRAY      SET16
    11  HAG        REAL                 / /                24  HEAD      REAL          ARRAY      SET6
 13560  IDES       INTEGER    ARRAY     SET3                3  IH        INTEGER                  / /
   404  INTRAC     INTEGER    ARRAY     SET20              14  INVERS    INTEGER                  / /
  1130  IPAN       INTEGER    ARRAY     SET10               2  IQ        INTEGER                  / /
   163  IR         INTEGER                                  1  ITER      INTEGER                  SET13
     0  ITOTAL     INTEGER               F.P.               2  ITRMAX    INTEGER                  SET13
   170  ITS        INTEGER    ARRAY     SET7              214  JTS       INTEGER       ARRAY      SET7
     4  LATRAL     INTEGER              / /                 0  LAX       INTEGER                  / /
     1  LAY        INTEGER              / /                 0  MACH      INTEGER       ARRAY      SET11
    23  NALPHA     INTEGER              SET11              22  NMACH     INTEGER                  SET11
   360  NPP        INTEGER    ARRAY     SET20            3720  ONSET     REAL          ARRAY      SET16
    50  PHINED     REAL       ARRAY     SET20             151  PI        REAL
   164  PION       REAL                                   153  PITCH     REAL
     6  PITCHQ     REAL                 / /                 5  PSI       REAL                     / /
   156  PSIRAD     REAL                                   214  RCS       REAL          ARRAY      SET20
   165  RCX        REAL                                  3640  RFLAG     REAL          ARRAY      SET3
     5  RLM        REAL                 SET13               0  RNCV      REAL          ARRAY      SET7
    24  RNMAX      REAL       ARRAY     SET7              154  ROLL      REAL
     7  POLLO      REAL                 / /               166  RSX       REAL
   174  SCNTL      REAL                                   201  SID       REAL
   157  SINALF     REAL                                  3720  SLOPE     REAL          ARRAY      SET2
 [illegible]  SX   INTEGER    ARRAY     SET3                0  TITLE     REAL          ARRAY      SET6
   454  TNL        REAL       ARRAY     SET10             620  TNT       REAL          ARRAY      SET10
    21  VINF       REAL                 SET11            7640  VSP       REAL          ARRAY      SET2
 [illegible]  VSS  REAL       ARRAY     SET10           10270  VST       REAL          ARRAY      SET20
   173  VX         REAL                                   174  VY        REAL
   175  VZ         REAL                                     4  WSPAN     REAL                     SET13
 [illegible]  X    REAL       ARRAY     SET1                3  XBAR      REAL                     SET15
 [illegible]  XGIRO  REAL                                 764  XTE       REAL          ARRAY      SET10
 [illegible]  Y    REAL       ARRAY     SET1              155  YAW       REAL
 [illegible]  YBAR  REAL                / /               171  YGIRO     REAL
 [illegible]  YY   REAL       ARRAY     SET20            4064  Z         REAL          ARRAY      SET1
 [illegible]  ZBAR  REAL                SET15            4230  ZC        REAL          ARRAY      SET1
 [illegible]  ZGIRO  REAL                                   0  ZLE1      REAL          ARRAY      SET20
 [illegible]  ZLEE  REAL      ARRAY     SET20            4350  ZZ        REAL          ARRAY      SET20

EXTERNALS           TYPE    ARGS
      COS           REAL      1 LIBRARY                        SIN       REAL          1 LIBRARY
      SQRT          REAL      1 LIBRARY
```

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       SUBROUTINE BOUNDY      74/74    OPT=1                                    FTN 4.5+410A       10/04/76  10.15.13         PAGE     4

 STATEMENT LABELS
     0  10

 LOOPS  LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
    44  10      * IR          62 10B       100B                  EXT REFS

 COMMON BLOCKS    LENGTH
        / /           13
        SET1        2250
        SET2        6000
        SET3        8000
        SET6        2220
        SET7         240
        SET10        700
        SET11         20
        SET13          6
        SET15          5
        SET16       4000
        SET20       6280

 STATISTICS
   PROGRAM LENGTH                    204B      132
   CM LABELED COMMON LENGTH        72031B    29721
   CM BLANK COMMON LENGTH             15B       13
```

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      CONTROL*VRLX.GAUSS                                        9/13/76  VORLAX     856
      C...                                                               VORLAX     857
            SUBROUTINE GAUSS (ITOTAL, REXPAR, EW, XRT)                   VORLAX     858
      C...                                                               VORLAX     859
      C...PURPOSE    TO SOLVE THE BOUNDARY CONDITION EQUATIONS BY THE    VORLAX     860
      C...           METHOD OF (CONTOLLED SUCCESSIVE OVER-RELAXATION).   VORLAX     861
      C...                                                               VORLAX     862
      C...INPUT      CALLING SEQUENCES                                   VORLAX     863
      C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.        VORLAX     864
      C...           REXPAR = RELAXATION PARAMETER.                      VORLAX     865
      C...           EW = ROW OF NORMALWASH MATRIX.                      VORLAX     866
      C...           COMMON<                                             VORLAX     867
      C...           CX, SX, LAX, ALOC, IDES, CHORD, RNMAX, INVERS,      VORLAX     868
      C...           ITRMAX.                                             VORLAX     869
      C...                                                               VORLAX     870
      C...OUTPUT     CALLING SEQUENCES                                   VORLAX     871
      C...           XRT = AUXILIARY VECTOR USED IN C.S.O.R. SOLUTION.   VORLAX     872
      C...           COMMON<                                             VORLAX     873
      C...           RIG, DCP, EPS, RLM, SLE, ITER, GAMMA, SLOPE.        VORLAX     874
      C...           GAMMA IS THE SOLUTION VECTOR OF BOUDARY CONDITION   VORLAX     875
      C...           EQUATIONS, I. E., HORSESHOE VORTEX CIRCULATION      VORLAX     876
      C...           STRENGTHS.                                          VORLAX     877
      C...           NOTES IF INVERS = 1 (DESIGN PROCESS) THEN GAMMA IS  VORLAX     878
      C...           PART INPUT AND PART OUTPUT.                         VORLAX     879
      C...                                                               VORLAX     880
      C...SUBROUTINES                                                    VORLAX     881
      C...CALLED     NONE.                                               VORLAX     882
      C...                                                               VORLAX     883
      C...DISCUSSION THIS SUBROUTINE SOLVES FOR THE CIRCULATION STRENGTH VORLAX     884
      C...           OF THE HORSESHOE VORTICES THAT SATISFY THE B.C. OF  VORLAX     885
      C...           NO MASS-FLUX ALONG THE NORMAL TO THE SURFACE AT THE VORLAX     886
      C...           CONTROL POINTS. THIS SOLUTION IS PERFORMED ITERA    VORLAX     887
      C...           TIVELY ROW BY ROW BY USING THE C.S.O.R. METHOD. IF  VORLAX     888
      C...           A GIVEN ROW IS PART OF A PANEL TO BE DESIGNED, I.E.,VORLAX     889
      C...           IDES = 1, THEN INSTEAD OF SOLVING FOR GAMMA(KRP),   VORLAX     890
      C...           THE COMPUTATION OF THE SLOPE CISTRIBUTION ALONG     VORLAX     891
      C...           THAT ROW IS PERFORMED BY MATRIX MULTIPLICATION.     VORLAX     892
      C...           SLOPE = EW *GAMMA.                                  VORLAX     893
      C...                                                               VORLAX     894
      C...                                                               VORLAX     895
            COMMON LAX, LAY, IQ, IR, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,  VORLAX     896
           * FLOATX, FLOATY, INVERS                                      VORLAX     897
            COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)           VORLAX     898
            COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)  VORLAX     899
            COMMON /SET6 /TITLE (20), HEAD (20), ALOC (2000)             VORLAX     900
            COMMON /SET7 /RNCV (20), RNMAX (100), IIS (20), JTS (100)    VORLAX     901
            COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),  VORLAX     902
           * TNT (100), ATE (100), IPAN (100)                            VORLAX     903
            COMMON /SET13 /RIG, ITER, ITRMAX, EPS , WSPAN, RLM           VORLAX     904
            COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)               VORLAX     905
            COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)   VORLAX     906
            INTEGER CX, SX                                               VORLAX     907
      C                                                                  VORLAX     908
            DIMENSION EW (ITOTAL), XRT (ITOTAL)                          VORLAX     909
      C                                                                  VORLAX     910
            REWIND 1                                                     VORLAX     911
      C                                                                  VORLAX     912
```

```
C...INITIALIZE ARRAYS.
C...
      DO 20 IR = 1, ITOTAL
C...
C...GAMMA IS THE SOLUTION VECTOR  AND XRT IS AN AUXILIARY
C...VECTOR TO BE USED IN THE RELAXATION SOLUTION.
C...
      GAMMA (IR) = 0.0
      XRT (IR) = 0.0
C...
C...IF THE IR-HORSESHOE VORTEX IS PART OF A DESIGN PANEL THEN
C...ITS CIRCULATION STRENGTH IS DIRECTLY COMPUTED FROM THE INPUT
C...LOAD DISTRIBUTION AND NO SOLUTION BY RELAXATION IS REQUIRED
C...FOR THE IR-ELEMENT.
C...
      IF (IDES (IR) .EQ. 0) GO TO 20
      IF (LAX .EQ. 1) GO TO 10
      GAMMA (IR) = 0.5 *DCP (IR)
      GO TO 20
   10 GAMMA (IR) = .5*DCP (IR) *CHORD (SX (IR)) /RNMAX (SX (IR))
   20 CONTINUE
C
C     **********  GAUSS-SEIDEL OVER-RELAXATION  **********
C
C
      RX1 = 1.0 + REXPAR
      RX2 = 1.0 - REXPAR
      BIGO = 1.0
      ITER = 1
C
C...BEGIN THE ITERATION SCHEME.
C...
   30 BIG = 0.0
      COUNT = 0.0
      EPSUM = 0.1E-11
C...
C...INDEX IRR SELECTS A ROW.
C...
      DO 90 IRR = 1, ITOTAL
C...
C...FROM HERE THROUGH LABEL 70 THE SUM OF THE PRODUCTS OF INFLU-
C...ENCE COEFF. TIMES CIRCULATION STRENGTH FOR A ROW IS COMPUTED
C...EXCLUDING THE DIAGONAL TERM.
C...
   40 SUM = 0.0
C...
C...UNIT 1 CONTAINS THE VORTEX CONTROL POINT NORMALWASH INFLUENCE
C...COEFF. MATRIX.
C...
      READ (1) EW
      IF (IDES (IRR) .EQ. 1) GO TO 90
      IF (IRR .EQ. 1) GO TO 60
      LAST = IRR - 1
      DO 50 IR = 1, LAST
   50 SUM = SUM + EW (IR) *GAMMA (IR)
      IF (IRR .EQ. ITOTAL) GO TO 60
   60 INITL  = IRR  + 1
```

```
      DO 70 IR = INITL, ITOTAL                                          VORLAX   973
   70 SUM = SUM + EW (IR) *GAMMA (IR)                                   VORLAX   974
C...                                                                    VORLAX   975
C...DETERMINE NEW VALUE OF A VARIABLE.                                  VORLAX   976
C...                                                                    VORLAX   977
   80 TEMP = (ALOC (IRR) - SUM) /EW (IRR)                               VORLAX   978
C...                                                                    VORLAX   979
C...APPLY OVER-RELAXATION USING A RELAXATION PARAMETER BASED ON         VORLAX   980
C...VARIABLE VALUES FROM PREVIOUS CYCLE.                                VORLAX   981
C...                                                                    VORLAX   982
      TEMP1 = TEMP - GAMMA (IRR)                                        VORLAX   983
      RAX = RX1                                                         VORLAX   984
      IF (TEMP1 *XRT (IRR) .LT. 0.) RAX =RX2                            VORLAX   985
      XRT (IRR) = TEMP1                                                 VORLAX   986
      TEMP2 = RAX *TEMP1                                                VORLAX   987
      GAMMA (IRR) = GAMMA (IRR) + TEMP2                                 VORLAX   988
C...                                                                    VORLAX   989
C...PUT LARGEST RELAXATION RESIDUAL IN BIG.                             VORLAX   990
C...                                                                    VORLAX   991
      VARMOD = ABS (TEMP2)                                              VORLAX   992
      IF (VARMOD .GT. BIG) BIG = VARMOD                                 VORLAX   993
C...                                                                    VORLAX   994
C...COUNT DETERMINES THE NUMBER OF VARIABLES THAT ARE BEING             VORLAX   995
C...SOLVED FOR.                                                         VORLAX   996
C...                                                                    VORLAX   997
      COUNT = COUNT + 1.0                                               VORLAX   998
C...                                                                    VORLAX   999
C...EPSUM IS TO BE USED IN CONJUCTION WITH COUNT TO DETERMINE A         VORLAX  1000
C...ROOT MEAN SQUARE VALUE OF ALL VARIABLES.                            VORLAX  1001
C...                                                                    VORLAX  1002
      EPSUM = EPSUM + GAMMA (IRR) *GAMMA (IRR)                          VORLAX  1003
   90 CONTINUE                                                          VORLAX  1004
      REWIND 1                                                          VORLAX  1005
C...                                                                    VORLAX  1006
C...RLM GIVES APPROXIMATE VALUE OF CONVERGENCE RATE OR MAGNIFI          VORLAX  1007
C...CATION FACTOR (MODULUS OF LARGEST EIGEN-VALUE).                     VORLAX  1008
C...                                                                    VORLAX  1009
      RLM = BIG /BIGO                                                   VORLAX  1010
C...                                                                    VORLAX  1011
C...ESTABLISH TOLERANCE LEVEL (EPS) AS A SMALL PERCENTAGE OF ROOT       VORLAX  1012
C...MEAN SQUARE VALUE OF ALL VARIABLES.                                 VORLAX  1013
C...                                                                    VORLAX  1014
      EPS = SQRT (EPSUM /(COUNT + 1.0)) /200.0                          VORLAX  1015
C...                                                                    VORLAX  1016
C...IF LARGEST RESIDUAL IS LESS THEN EPS, PROCESS HAS CONVERGED.        VORLAX  1017
C...                                                                    VORLAX  1018
      IF (BIG .LT. EPS .OR. COUNT .LT. 0.5) GO TO 100                   VORLAX  1019
C...                                                                    VORLAX  1020
C...IF ITERATION COUNTER EXCEEDS MAXIMUM ALLOWABLE, END RELAXATION.     VORLAX  1021
C...                                                                    VORLAX  1022
      IF (ITER .GE. ITRMAX) GO TO 100                                   VORLAX  1023
      ITER = ITER + 1                                                   VORLAX  1024
      BIGO = BIG                                                        VORLAX  1025
      GO TO 30                                                          VORLAX  1026
C                                                                       VORLAX  1027
C     **********  END OF GAUSS-SEIDEL OVER-RELAXATION  **********       VORLAX  1028
C                                                                       VORLAX  1029
```

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      C...FROM HERE TO END OF SUBROUTINE THE DESIGN PROCESS IS PERFORMED.      VORLAX   1030
      C...IF NO DESIGN IS INVOLVED (INVERS = 0) THEN THIS SEGMENT IS BY-       VORLAX   1031
      C...PASSED.                                                              VORLAX   1032
      C                                                                        VORLAX   1033
       100  IF (INVERS .EQ. 0) GO TO 150                                       VORLAX   1034
      C...                                                                     VORLAX   1035
      C...UNIT 9 CONTAINS THE LEADING EDGE NORMALWASH INFLUENCE COEFF.         VORLAX   1036
      C...MATRIX.                                                              VORLAX   1037
      C...                                                                     VORLAX   1038
            REWIND 9                                                           VORLAX   1039
            DO 140 IRR = 1, ITOTAL                                             VORLAX   1040
      C...                                                                     VORLAX   1041
      C...UNIT 1 CONTAINS THE VORTEX CONTROL POINT NORMALWASH INFLUENCE        VORLAX   1042
      C...COEFF. MATRIX.                                                       VORLAX   1043
      C...                                                                     VORLAX   1044
            READ (1) EW                                                        VORLAX   1045
      C...                                                                     VORLAX   1046
      C...THE LEADING EDGE NORMALWASH INFLUENCE COEFF. MATRIX IS ONLY          VORLAX   1047
      C...DEFINED FOR LEADING EDGE ELEMENTS (CX = 1). THEREFORE ITS            VORLAX   1048
      C...READING IN IS BYPASSED IF THE ELEMENT IS NOT AT THE L. E..           VORLAX   1049
      C...                                                                     VORLAX   1050
            IF (CX (IRR) .GT. 1) GO TO 110                                     VORLAX   1051
            READ (9) XRT                                                       VORLAX   1052
       110  IF (IDES (IRR) .EQ. 0) GO TO 140                                   VORLAX   1053
      C...                                                                     VORLAX   1054
      C...COMPUTE SURFACE SLOPE AT VORTEX CONTROL POINT LOCATION, SLOPE.       VORLAX   1055
      C...                                                                     VORLAX   1056
            THETA = 0.                                                         VORLAX   1057
            DO 120 IR = 1, ITOTAL                                              VORLAX   1058
            THETA = THETA + EW (IR) *GAMMA (IR)                                VORLAX   1059
       120  CONTINUE                                                           VORLAX   1060
            SLOPE (IRR) = THETA                                                VORLAX   1061
      C...                                                                     VORLAX   1062
      C...COMPUTE SURFACE SLOPE AT LEADING EDGE OF VORTEX STRIP                VORLAX   1063
      C...CENTERLINE, SLE.                                                     VORLAX   1064
      C...                                                                     VORLAX   1065
            IF (CX (IRR) .GT. 1) GO TO 140                                     VORLAX   1066
            THETA = 0.0                                                        VORLAX   1067
            DO 130 IR = 1, ITOTAL                                              VORLAX   1068
            THETA = THETA + XRT (IR) *GAMMA (IR)                               VORLAX   1069
       130  CONTINUE                                                           VORLAX   1070
            SLE (SA (IRR)) = THETA                                             VORLAX   1071
       140  CONTINUE                                                           VORLAX   1072
            REWIND 1                                                           VORLAX   1073
            REWIND 9                                                           VORLAX   1074
       150  RETURN                                                             VORLAX   1075
            END                                                                VORLAX   1076


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3   GAUSS
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       SUBROUTINE GAUSS      74/74   OPT=1                          FTN 4.5+410A      10/04/76  10.15.13        PAGE     5

VARIABLES     SN  TYPE            RELOCATION
   334  ALOC      REAL       ARRAY    SET6              0  RIG        REAL                 SET13
   275  BIGO      REAL                                  0  CHORD      REAL       ARRAY     SET10
   276  COUNT     REAL                                  0  CX         INTEGER    ARRAY     SET3
     0  DCP       REAL       ARRAY    SET2            144  DL         REAL       ARRAY     SET10
     3  EPS       REAL                SET13           277  EPSUM      REAL
     0  EW        REAL       ARRAY     F.P.            12  FLOATX     REAL                 / /
    13  FLOATY    REAL                / /               0  GAMMA      REAL       ARRAY     SET16
    11  HAG       REAL                / /              24  HEAD       REAL       ARRAY     SET6
 13560  IDES      INTEGER    ARRAY    SET3              3  IH         INTEGER              / /
   303  INITL     INTEGER                              14  INVERS     INTEGER              / /
  1130  IPAN      INTEGER    ARRAY    SET10             2  IQ         INTEGER              / /
   272  IR        INTEGER                             300  IRR        INTEGER
     1  ITER      INTEGER             SET13             0  ITOTAL     INTEGER               F.P.
     2  ITRMAX    INTEGER             SET13           170  ITS        INTEGER    ARRAY     SET7
   214  JTS       INTEGER    ARRAY    SET7            302  LAST       INTEGER
     4  LATRAL    INTEGER             / /               0  LAX        INTEGER              / /
     1  LAY       INTEGER             / /            3720  ONSET      REAL       ARRAY     SET16
     6  PITCHQ    REAL                / /               5  PSI        REAL                 / /
   306  RAX       REAL                                  0  REXPAN     REAL                  F.P.
  7640  RFLAG     REAL       ARRAY    SET3              5  RLM        REAL                 SET13
     0  RNCV      REAL       ARRAY    SET7             24  RNMAX      REAL       ARRAY     SET7
     7  ROLLQ     REAL                / /             273  RX1        REAL
   274  RX2       REAL                                 50  SLE        REAL       ARRAY     SET19
     0  SLE1      REAL       ARRAY    SET19            24  SLE2       REAL       ARRAY     SET19
  3720  SLOPE     REAL       ARRAY    SET2            311  SUM        REAL
  3720  SX        INTEGER    ARRAY    SET3            304  TEMP       REAL
   305  TEMP1     REAL                                307  TEMP2      REAL
   311  THETA     REAL                                  0  TITLE      REAL       ARRAY     SET6
   454  TNL       REAL       ARRAY    SET10           620  TNT        REAL       ARRAY     SET10
   310  VARMOD    REAL                               7640  VSP        REAL       ARRAY     SET2
   310  VSS       REAL       ARRAY    SET10             4  WSPAN      REAL                 SET13
     0  XRT       REAL       ARRAY     F.P.           744  XTE        REAL       ARRAY     SET10
    10  YAWQ      REAL                / /             214  ZETA       REAL       ARRAY     SET19

FILE NAMES        MODE
       TAPE1      UNFMT                    TAPE9      UNFMT

EXTERNALS           TYPE    ARGS
       SQRT       REAL        1 LIBRARY

INLINE FUNCTIONS    TYPE    ARGS
       ABS        REAL        1  INTRIN

STATEMENT LABELS
    33  10                                     37  20                                                    46  30
     0  40            INACTIVE                  0  50                                                    76  60
     0  70                                    110  80                                                   137  90
   162  100                                   203  110                                                    0  120
     0  130                                   233  140                                                  241  150

LOOPS  LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
    26  20          IR          60  78      128         OPT
    52  90        * IRR         96 146      70B                    EXT REFS  NOT INNER
    67  50          IR         111 112       4B       INSTACK
   103  70          IR         115 116       4B       INSTACK
   166  140       * IRR        182 214      50B                    EXT REFS  NOT INNER
   211  120         IR         200 202       4B       INSTACK
```

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        SUBROUTINE GAUSS        74/74    OPT=1                                 FTN 4.5+410A        10/04/76  10.15.13          PAGE

LOOPS   LABEL     INDEX       FROM-TO     LENGTH     PROPERTIES
  224   130       IR           210 212        4B      INSTACK

COMMON  BLOCKS    LENGTH
        / /           13
        SET2        6000
        SET3        8000
        SET6        2220
        SET7         240
        SET10        700
        SET13          6
        SET16       4000
        SET19        240

STATISTICS
  PROGRAM LENGTH                 342B      226
  CM LABELED COMMON LENGTH     51636B    21406
  CM BLANK COMMON LENGTH          15B       13
```

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      CONTROL*VRLX.GEOM                                            9/16/76  VORLAX   1077
      C...                                                                  VORLAX   1078
            SUBROUTINE GEOM (ITOTAL)                                        VORLAX   1079
      C...                                                                  VORLAX   1080
      C...PURPOSE    TO COMPUTE THE VORTEX LATTICE GEOMETRY AND SURFACE     VORLAX   1081
      C...           SLOPES AT THE CONTROL POINTS. ALSO TO COMPUTE THE      VORLAX   1082
      C...           LOAD DISTRIBUTION AT THE CORRESPONDING LOAD POINTS     VORLAX   1083
      C...           IF DESIGN PROCESS IS INVOKED (IDES = 1).               VORLAX   1084
      C...                                                                  VORLAX   1085
      C...INPUT      CALLING SEQUENCES                                      VORLAX   1086
      C...           NONE.                                                  VORLAX   1087
      C...           COMMONS                                                VORLAX   1088
      C...           DL, ITS, LAX, LAY, NPP, PDL, RCS, VSS, NPAN, NVOR,     VORLAX   1089
      C...           RNCV, SLE1, SLE2, ZLE1, ZLE2, AINC1, AINC2, DNDX1,     VORLAX   1090
      C...           DNDX2, GAMMA, LESWP, PSPAN, SYNTH, TAPER, XAPEX,       VORLAX   1091
      C...           YAPEX, ZAPEX, CSTART, INTRAC, IQUANT, LATRAL,          VORLAX   1092
      C...           PHIMED.                                                VORLAX   1093
      C...                                                                  VORLAX   1094
      C...OUTPUT     CALLING SEQUENCES                                      VORLAX   1095
      C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.           VORLAX   1096
      C...           COMMONS                                                VORLAX   1097
      C...           X, Y, Z, CX, DL, NT, SX, YY, ZZ, DCP, JTS, SLE,        VORLAX   1098
      C...           TNL, TNT, VSP, VSS, VST, XTE, ALOC, IPAN, SMAX,        VORLAX   1099
      C...           ZETA, CHORD, RNMAX, SLOPE, NPANAS.                     VORLAX   1100
      C...           NOTES DL AND VSS MAY BE EITHER INPUT OR OUTPUT         VORLAX   1101
      C...           DEPENDING ON CONFIGURATION CONDITIONS.                 VORLAX   1102
      C...                                                                  VORLAX   1103
      C...SUBROUTINES                                                       VORLAX   1104
      C...CALLED     NONE.                                                  VORLAX   1105
      C...                                                                  VORLAX   1106
      C...DISCUSSION THE VORTEX LATTICE GEOMETRY IS LAID OUT PANEL BY       VORLAX   1107
      C...           PANEL BASED ON THE GEOMETRIC AND VORTEX DISTRIBU       VORLAX   1108
      C...           TION CHARACTERISTICS SPECIFIED FOR THE GIVEN PANEL     VORLAX   1109
      C...           IN THE INPUT DATA (INPUT SUBROUTINE). EACH PANEL       VORLAX   1110
      C...           IS SUBDIVIDED INTO A NUMBER OF X-AXIALWISE STRIPS      VORLAX   1111
      C...           (NVOR), EACH STRIP CONTAINING A GIVEN NUMBER (RNMAX =  VORLAX   1112
      C...           RNCV) OF HORSESHOE VORTICES WHOSE BOUND TRAILING LEGS  VORLAX   1113
      C...           COINCIDE WITH THE X-AXIALWISE EDGES OF THE STRIP IF    VORLAX   1114
      C...           THE PARAMETER NPP = 0. WHEN NPP = 1 THERE IS NO        VORLAX   1115
      C...           LONGER A CONTINUOUS STRIP OF VORTICES SINCE THEY ARE   VORLAX   1116
      C...           NOT LOCATED IN THE SAME PLANE, IN THIS CASE (NPP =     VORLAX   1117
      C...           1) THE STRIP BECOMES AN ARRAY OR ROW OF VORTICES       VORLAX   1118
      C...           LOCATED IN TANDEM BUT WHOSE SPANS ARE NOT NECES        VORLAX   1119
      C...           SARILY EQUAL. EACH STRIP OR VORTEX ROW IS IDENTI       VORLAX   1120
      C...           FIED BY AN INDEX (SX). EACH HORSESHOE VORTEX IN A      VORLAX   1121
      C...           GIVEN STRIP OR ROW IS IDENTIFIED BY A SECOND INDEX     VORLAX   1122
      C...           (CX), THE VALUE CX = 1 DENOTING THE LEADING EDGE       VORLAX   1123
      C...           ELEMENT, AND CX = RNMAX = RNCV DENOTING THE LAST,      VORLAX   1124
      C...           OR TRAILING EDGE, HORSESHOE OF THE ROW. THEREFORE      VORLAX   1125
      C...           EACH AND EVERY HORSESHOE VORTEX IS UNIQUELY IDEN       VORLAX   1126
      C...           TIFIED BY EITHER AN OVERALL INDEX (WHICH RUNS FROM     VORLAX   1127
      C...           1 TO ITOTAL) OR BY THE PAIR OF VALUES (CX, SX).        VORLAX   1128
      C...           THE SPATIAL LAY-OUT OF THE VORTEX LATTICE CORRES       VORLAX   1129
      C...           PONDING TO A GIVEN PANEL DEPENDS ON THE VALUES OF      VORLAX   1130
      C...           TWO PARAMETERS: PDL AND NPP. IF PDL .LE. 360.0 THEN    VORLAX   1131
      C...           THE TRANSVERSE VORTEX SEGMENTS OF THE SAME VALUE OF    VORLAX   1132
      C...           CX FORM A CONTINUOUS STRAIGHT LINE, BUT IF PDL .GT.    VORLAX   1133
```

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C...           360.0 THEN THE TRANSVERSE VORTEX SEGMENTS OF SAME CX,    VORLAX  1134
C...           THOUGH STILL CONTINUOUS, FORM A POLYGONAL LINE           VORLAX  1135
C...           WHEN PROJECTED ON A PLANE NORMAL TO THE X-AXIS. IF       VORLAX  1136
C...           NPP = 0 THEN ALL THE TRANSVERSE VORTEX SEGMENTS          VORLAX  1137
C...           OF A GIVEN ROW (SAME SX) LIE IN THE SAME PLANE,          VORLAX  1138
C...           BUT IF NPP = 1 THEN THE TRANSVERSE SEGMENTS OF A         VORLAX  1139
C...           ROW ARE LAID ON THE ACTUAL BODY SURFACE. THE BOUND       VORLAX  1140
C...           TRAILING LEGS OR SEGMENTS ARE ALWAYS PARALLEL TO         VORLAX  1141
C...           THE X-AXIS (UP TO THE TRAILING EDGE OF THE GIVEN         VORLAX  1142
C...           STRIP OR ROW).                                           VORLAX  1143
C...                                                                    VORLAX  1144
C...                                                                    VORLAX  1145
      COMMON LAX, LAY, IO, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,   VORLAX  1146
     * FLOATX, FLOATY, INVERS                                           VORLAX  1147
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                 VORLAX  1148
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                VORLAX  1149
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)     VORLAX  1150
      COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20)    VORLAX  1151
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),       VORLAX  1152
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),    VORLAX  1153
     * PSPAN (40), NVOR (40)                                            VORLAX  1154
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                 VORLAX  1155
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)         VORLAX  1156
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),       VORLAX  1157
     * TNT (100), XTE (100), IPAN (100)                                 VORLAX  1158
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                            VORLAX  1159
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                    VORLAX  1160
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)        VORLAX  1161
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),     VORLAX  1162
     * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)            VORLAX  1163
      INTEGER TITLE, CX, SX                                             VORLAX  1164
      REAL NVOR, LESWP                                                  VORLAX  1165
      PI = 3.14159                                                      VORLAX  1166
      DTR = 0.01745329                                                  VORLAX  1167
C                                                                       VORLAX  1168
C  LATTICE GEOMETRY                                                     VORLAX  1169
C                                                                       VORLAX  1170
C...INITIALIZE INDICES.                                                 VORLAX  1171
C...                                                                    VORLAX  1172
      IR = 0                                                            VORLAX  1173
      IRR = 0                                                           VORLAX  1174
      SMAX = 0.                                                         VORLAX  1175
      NPANAS = 0                                                        VORLAX  1176
      KED = 0                                                           VORLAX  1177
      KEG = 0                                                           VORLAX  1178
      SIGN = 1.0                                                        VORLAX  1179
      I = 1                                                             VORLAX  1180
      ICYCLE = 1                                                        VORLAX  1181
      JUMP = 0                                                          VORLAX  1182
C                                                                       VORLAX  1183
C...IN DEFINING THE VORTEX LATTICE GEOMETRY, THE COMPUTATION IS         VORLAX  1184
C...PERFORMED ONE PANEL AT A TIME (STATEMENTS INCLUDED BETWEEN          VORLAX  1185
C...LABELS 10 AND 80). IF THE CONFIGURATION IS SYMMETRICAL THE          VORLAX  1186
C...COMPUTATION EXTENDS OVER ONE HALF OF IT ONLY (MIRROR SYM            VORLAX  1187
C...METRY IS ASSUMED). OTHERWISE THE COMPUTATIONAL CYCLE IS RE          VORLAX  1188
C...PEATED FOR THE OTHER HALF OF THE CONFIGURATION.                     VORLAX  1189
C...                                                                    VORLAX  1190
```

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      C                                                                 VORLAX 1191
      C                                                                 VORLAX 1192
       10   SMAX = SMAX + NVOR (I)                                      VORLAX 1193
            NPANAS = NPANAS + 1                                         VORLAX 1194
            DELTA = 0.5 *PSPAN (I) /NVOR (I)                            VORLAX 1195
            ETA = 0.                                                    VORLAX 1196
            TAO = TAN (DTR * LESWP (I)) *SIGN                           VORLAX 1197
            NV = NVOR (I)                                               VORLAX 1198
            XNOT = XAPEX (I)                                            VORLAX 1199
            YNOT = YAPEX (I) *SIGN                                      VORLAX 1200
            ZNOT = ZAPEX (I)                                            VORLAX 1201
      C                                                                 VORLAX 1202
      C                                                                 VORLAX 1203
            KEDOR = KED                                                 VORLAX 1204
            KEGOR = KEG                                                 VORLAX 1205
      C                                                                 VORLAX 1206
      C                                                                 VORLAX 1207
            DO 80 J = 1, NV                                             VORLAX 1208
            IR = IR + 1                                                 VORLAX 1209
            IPAN (IR) = I                                               VORLAX 1210
            RNMAX (IR) = RNCV (I)                                       VORLAX 1211
      C...                                                              VORLAX 1212
      C...DETERMINE DISTRIBUTION OF VORTEX TRAILING LEGS (LATERAL VORTEX VORLAX 1213
      C...SPACING), IF LAT = 0 $ COSINE SPACING, IF LAT = 1 $ EQUAL     VORLAX 1214
      C...SPACING. DELTA IS HALF THE LATERAL VORTEX SPACING.            VORLAX 1215
      C...                                                              VORLAX 1216
            IF (LAT .EQ. 0 ) DELTA = 0.25 *PSPAN (I) *(COS (PI *FLOAT(J-1)/ VORLAX 1217
           * NVOR (I)) - COS (PI *FLOAT (J) /NVOR (I)))                 VORLAX 1218
      C...                                                              VORLAX 1219
      C...IF PDL .LE. 360.0 THEN VSS AND DL HAVE TO BE COMPUTED, OTHER  VORLAX 1220
      C...WISE (PDL .GT. 360.) THEY HAVE ALREADY BEEN COMPUTED DURING THE VORLAX 1221
      C...INPUT PROCESS (INPUT SUBROUTINE). THE INDEX JUMP HELPS DETER  VORLAX 1222
      C...MINE THE VALUES TO BE MIRRORED WHEN BOTH LEFT AND RIGHT HALVES VORLAX 1223
      C...OF THE CONFIGURATION ARE BEING LATTICED (ASYMMETRICAL CASE,   VORLAX 1224
      C...I. E., LATRAL = 1).                                           VORLAX 1225
      C...                                                              VORLAX 1226
            IF (PDL (I) .LE. 360.) VSS (IR) = DELTA                     VORLAX 1227
            IF (PDL (I) .LE. 360.0 ) DL (IR) = PDL (I)                  VORLAX 1228
            VSS (IR) = VSS (IR - JUMP)                                  VORLAX 1229
            RCS (IR) = RCS (IR - JUMP)                                  VORLAX 1230
            DL (IR) = DL (IR - JUMP) *SIGN                              VORLAX 1231
            PHIMED (IR) = PHIMED (IR - JUMP) *SIGN - 90.0 *(SIGN - 1.0) VORLAX 1232
            SID = SIN (DTR *DL (IR))                                    VORLAX 1233
            COD = COS (DTR *DL (IR))                                    VORLAX 1234
            DTJ = VSS (IR)                                              VORLAX 1235
            IF (J - 1) 30, 30, 20                                       VORLAX 1236
       20   XNOT = XLE + VSS (IR - 1) *TAO *SIGN                        VORLAX 1237
            YNOT = Y (IR - 1) + VSS (IR - 1) *COS (DTR *DL(IR - 1)) *SIGN VORLAX 1238
            ZNOT = Z (IR - 1) + VSS (IR - 1) *SIN (DTR *DL (IR -1)) *SIGN VORLAX 1239
            ETA = ETA + VSS (IR - 1) /PSPAN (I)                         VORLAX 1240
      C...                                                              VORLAX 1241
      C...DETERMINE LATERAL COORDINATES (Y, Z) OF STRIP CENTERLINE OR   VORLAX 1242
      C...VORTEX ROW REFERENCE LINE. BY DEFINITION THIS LINE IS PARALLEL VORLAX 1243
      C...TO X-AXIS.                                                    VORLAX 1244
      C...                                                              VORLAX 1245
       30   Y (IR) = YNOT + DTJ *COD *SIGN                              VORLAX 1246
            Z (IR) = ZNOT + DTJ *SID *SIGN                              VORLAX 1247
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                XLE = XNOT + DTJ *TAD *SIGN                                   VORLAX   1248
                ETA = ETA + DTJ /PSPAN (I)                                    VORLAX   1249
            C...                                                              VORLAX   1250
            C...COMPUTE TANGENT OF LOCAL INCIDENCE (ANGLE BETWEEN CHORDLINE   VORLAX   1251
            C...AND STRIP REFERENCE LINE) BY ASSUMING STRAIGHT ELEMENT LINE   VORLAX   1252
            C...LOFTING (THE TANGENT IS CALLED DINC).                         VORLAX   1253
            C...                                                              VORLAX   1254
                DINC = AINC1 (I) *(1. - ETA) + AINC2 (I) *TAPER (I) *ETA      VORLAX   1255
                DINC = DINC /(1.0 - ETA + TAPER (I) *ETA)                     VORLAX   1256
            C...                                                              VORLAX   1257
            C...THE PARAMETER INTRAC DETERMINES WHETHER THE PANEL UNDER CON   VORLAX   1258
            C...SIDERATION IS PART OF A QUASI-CYLINDRICAL BODY OR PART OF A   VORLAX   1259
            C...OR PART OF A FUSIFORM BODY (INTRAC = 1). FOR A FUSIFORM BODY  VORLAX   1260
            C...AINC1 IS THE TANGENT OF THE INCIDENCE OF THE BODY AXIS WITH   VORLAX   1261
            C...RESPECT TO THE X-Y PLANE, AND AINC2 IS THE TANGENT OF THE     VORLAX   1262
            C...INCIDENCE OF THE BODY AXIS WITH RESPECT TO THE X-Z PLANE.     VORLAX   1263
            C...                                                              VORLAX   1264
                IF (INTRAC (I) .EQ. 1)  DINC = AINC1 (I) *COD + AINC2 (I) *SID VORLAX   1265
            C...                                                              VORLAX   1266
            C...COMPUTE CHORD LENGTH (CHORD) ALONG STRIP CENTERLINE BY        VORLAX   1267
            C...ASSUMING STRAIGHT PANEL LEADING AND TRAILING EDGES AND        VORLAX   1268
            C...NEGLECTING THE EFFECT OF TWIST.                               VORLAX   1269
            C...                                                              VORLAX   1270
                CHORD (IR) = CSTART (I) *(1.0 + ETA *(TAPER (I) - 1.0))       VORLAX   1271
            C...                                                              VORLAX   1272
            C...COMPUTE LEADING EDGE SLOPE (SLE).                             VORLAX   1273
            C...                                                              VORLAX   1274
                SLE (IR) = SLE1 (I) *(1. - ETA) + SLE2 (I) *ETA + DINC        VORLAX   1275
                IF (INTRAC (I) .EQ. 0)  GO TO  40                             VORLAX   1276
                FRC = RCS (IR) /CHORD (IR)                                    VORLAX   1277
                CODIF = COS (DTR *(90.0 - PHIMED (IR) + DL (IR)))             VORLAX   1278
             40 JTS (IR) = ITS (I)                                            VORLAX   1279
                ZETA (IR) = DINC                                              VORLAX   1280
            C...                                                              VORLAX   1281
            C...COMPUTE TANGENT OF LEADING EDGE SWEEP (TNL), TANGENT OF       VORLAX   1282
            C...TRAILING EDGE SWEEP (TNT), AND X-ORDINATE OF TRAILING EDGE    VORLAX   1283
            C...OF STRIP CENTERLINE (XTE).                                    VORLAX   1284
            C...                                                              VORLAX   1285
                TNL (IR) = TAD                                                VORLAX   1286
                TNT (IR) = TAD - SIGN *CSTART (I) *(1. - TAPER (I)) /PSPAN (I) VORLAX   1287
                XTE (IR) = XLE + CHORD (IR)                                   VORLAX   1288
                MAX = RNMAX (IR)                                              VORLAX   1289
                PION = PI /RNMAX (IR)                                         VORLAX   1290
            C                                                                 VORLAX   1291
            C                                                                 VORLAX   1292
            C...THE DO-LOOP ENDED BY LABEL 70 COMPUTES FOR A GIVEN STRIP OR   VORLAX   1293
            C...VORTEX ROW THE VALUES OF TRANSVERSE SEGMENT MIDPOINT X-ORDI   VORLAX   1294
            C...NATES (X), THE TANGENT OF THE SWEEP OF THOSE SEGMENTS (VSP),  VORLAX   1295
            C...THE SLOPE OF THE SURFACE AT THE CONTROL POINTS (SLOPE) AS     VORLAX   1296
            C...DETERMINED BY STRAIGHT ELEMENT LINE LOFTING, OR IF A DESIGN   VORLAX   1297
            C...PROCESS IS INVOKED (SYNTH = 1.), THE VALUE OF THE LOAD COEFF. VORLAX   1298
            C...(DCP) AT VORTEX MIDPOINT IS DETERMINED BY LINEAR INTERPOLATION. VORLAX 1299
            C...ALSO EACH HORSESHOE VORTEX IS GIVEN A VALUE OF IDES WHICH DE  VORLAX   1300
            C...TERMINES WHETHER ITS LOAD COEFFICIENT IS A KNOWN (INPUT)      VORLAX   1301
            C...QUANTITY (IDES = 1) OR IT IS TO BE SOLVED FOR (IDES = 0).     VORLAX   1302
            C...IN ADDITION, THE HORSESHOE VORTICES ARE TAGGED WITH THE PROPER VORLAX  1303
            C...CX - SX VALUES. ALOC IS AN AUXILIARY ARRAY WHICH CONTAINS THE VORLAX   1304
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      C...THE DISPLACEMENTS OF THE VORTEX MIDPOINTS (LOAD POINTS) WITH       VORLAX   1305
      C...RESPECT TO THE STRIP REFERENCE LINE, IN PERCENT OF LOCAL           VORLAX   1306
      C...CHORD LENGTH.                                                      VORLAX   1307
      C...                                                                   VORLAX   1308
            DO 70 K = 1, MAX                                                 VORLAX   1309
            KEDK = KEDOR + K                                                 VORLAX   1310
            KEGK = KEGOR + K                                                 VORLAX   1311
            IF (J .GT. 1)  GO TO 50                                          VORLAX   1312
            KED = KED + 1                                                    VORLAX   1313
            KEG = KEG + 1                                                    VORLAX   1314
       50   IRR = IRR + 1                                                    VORLAX   1315
            CX (IRR) = K                                                     VORLAX   1316
            SX (IRR) = IR                                                    VORLAX   1317
            RK = K                                                           VORLAX   1318
            DTJ = .5 * (1.0 - COS ((RK - .5) *PION))                         VORLAX   1319
            IF (LAX .EQ. 1) DTJ = (RK - 0.75) /RNMAX (IR)                    VORLAX   1320
            X (IRR) = XLE + DTJ *CHORD (IR)                                  VORLAX   1321
            VSP(IRR) = TAD -DTJ *CSTART(I) *(1.-TAPER(I))/ABS(PSPAN(I)) *SIGN VORLAX   1322
            ALOC (IRR) = 0.0                                                 VORLAX   1323
            IF (SYNTH (I) .GT. 0.5) GO TO 60                                 VORLAX   1324
            IDES (IRR) = 0                                                   VORLAX   1325
            SLOPE (IRR) = DNDX1 (KEDK) *(1. - ETA) + DNDX2 (KEDK) *ETA + DINC VORLAX   1326
            KEGK2 = KEGK + MAX                                               VORLAX   1327
            ALOC (IRR) = GAMMA (KEGK) *(1. - ETA) + GAMMA (KEGK2) *ETA       VORLAX   1328
            ALOC (IRR) = ALOC (IRR) +  DINC *DTJ *100.                       VORLAX   1329
            IF (INTRAC (I) .EQ. 0)  GO TO 70                                 VORLAX   1330
            SLOPE (IRR) = DNDX1 (KEDK) *COD + FHC *DNDX2 (KEDK) *CODIF + DINC VORLAX   1331
            ALOC (IRR) = GAMMA (KEGK2)                                       VORLAX   1332
            GO TO 70                                                         VORLAX   1333
       60   DCP (IRR) = DNDX1 (KEDK) + (DNDX2 (KEDK) - DNDX1 (KEDK)) *ETA     VORLAX   1334
            IDES (IRR) = 1                                                   VORLAX   1335
            SLOPE (IRR) = 0.0                                                VORLAX   1336
       70   CONTINUE                                                         VORLAX   1337
      C                                                                      VORLAX   1338
      C                                                                      VORLAX   1339
       80   CONTINUE                                                         VORLAX   1340
      C                                                                      VORLAX   1341
      C                                                                      VORLAX   1342
      C                                                                      VORLAX   1343
            KEG = KEG + MAX                                                  VORLAX   1344
      C                                                                      VORLAX   1345
      C                                                                      VORLAX   1346
            IF (ICYCLE .EQ. 2) GO TO 100                                     VORLAX   1347
            I = I + 1                                                        VORLAX   1348
            IF (I - NPAN) 10, 10, 90                                         VORLAX   1349
       90   IF (LATRAL .EQ. 0) GO TO 110                                     VORLAX   1350
      C...                                                                   VORLAX   1351
      C...                                                                   VORLAX   1352
      C...IF CONFIGURATION OR FLIGHT CONDITION IS ASYMMETRICAL (LATRAL       VORLAX   1353
      C...= 1) THEN DETERMINE PANEL HAS TO BE DUPLICATED FOR OPPOSSITE       VORLAX   1354
      C...HALF OF CONFIGURATION.                                             VORLAX   1355
      C...                                                                   VORLAX   1356
      C...                                                                   VORLAX   1357
            ICYCLE = 2                                                       VORLAX   1358
            JUMP = IR                                                        VORLAX   1359
            I = 0                                                            VORLAX   1360
            SIGN = - 1.0                                                     VORLAX   1361
      KED = 0                                                           VORLAX  1362
      KEG = 0                                                           VORLAX  1363
  100 I = I + 1                                                         VORLAX  1364
      IF (I .GT. NPAN) GO TO 110                                        VORLAX  1365
      NV = NVOR (I)                                                     VORLAX  1366
      NCORD = RNCV (I)                                                  VORLAX  1367
      IF (IQUANT(I) .EQ. 1)  KED = KED + NCORD                          VORLAX  1368
      IF (IQUANT(I) .EQ. 1)  KEG = KEG + 2 *NCORD                       VORLAX  1369
      JUMP = JUMP + NV * (IQUANT (I) - 2)                               VORLAX  1370
      IF (IQUANT (I) .EQ. 1) GO TO 100                                  VORLAX  1371
      GO TO 10                                                          VORLAX  1372
  110 ITOTAL = IRR                                                      VORLAX  1373
      NT = SMAX                                                         VORLAX  1374
C                                                                       VORLAX  1375
C                                                                       VORLAX  1376
      IRR = 0                                                           VORLAX  1377
C                                                                       VORLAX  1378
C...THE DO-LOOP ENDED BY LABEL 190 COMPUTES THE LATERAL COORDI          VORLAX  1379
C...NATES OF VORTEX MIDPOINTS (YY AND ZZ) AND THE SEMISPAN OF           VORLAX  1380
C...EACH HORSESHOE. IF NPP = 0 THE VORTEX MIDPOINT LATERAL CO           VORLAX  1381
C...ORDINATES COINCIDE WITH THOSE OF STRIP CENTERLINE.                  VORLAX  1382
C...                                                                    VORLAX  1383
      DO 190 IR = 1, NT                                                 VORLAX  1384
      MAX = RNMAX (IR)                                                  VORLAX  1385
      DNORM = CHORD (IR) *0.010                                         VORLAX  1386
      INX = IPAN (IR)                                                   VORLAX  1387
      ISEND = 1 + INTRAC (INX)                                          VORLAX  1388
      GO TO (120, 130), ISEND                                           VORLAX  1389
  120 CDL = COS (DTR *DL (IR))                                          VORLAX  1390
      SDL = SIN (DTR *DL (IR))                                          VORLAX  1391
      GO TO 140                                                         VORLAX  1392
  130 CDL = SIN (DTR *PHIMED (IR))                                      VORLAX  1393
      SDL = - COS (DTR *PHIMED (IR))                                    VORLAX  1394
  140 DO 180 L = 1, MAX                                                 VORLAX  1395
      IRR = IRR + 1                                                     VORLAX  1396
      YY (IRR) = Y (IR)                                                 VORLAX  1397
      ZZ (IRR) = Z (IR)                                                 VORLAX  1398
      VST (IRR) = VSS (IR)                                              VORLAX  1399
      IF (NPP (INX) .EQ. 0) GO TO 180                                   VORLAX  1400
      GO TO (150, 160), ISEND                                           VORLAX  1401
  150 DELTA = ALOC (IRR) *DNORM                                         VORLAX  1402
      GO TO 170                                                         VORLAX  1403
  160 DELTA = RCS (IR) *(0.1 *SQRT (ALOC (IRR)) - 1.0)                  VORLAX  1404
  170 YY (IRR) = Y (IR) - DELTA *SDL                                    VORLAX  1405
      ZZ (IRR) = Z (IR) + DELTA *CDL                                    VORLAX  1406
      VOREX = 1.0                                                       VORLAX  1407
      IF (INTRAC (INX) .EQ. 1)  VOREX = (RCS (IR) + DELTA) /RCS (IR)    VORLAX  1408
      VST (IRR) = VOREX *VSS (IR)                                       VORLAX  1409
  180 CONTINUE                                                          VORLAX  1410
  190 CONTINUE                                                          VORLAX  1411
C                                                                       VORLAX  1412
C                                                                       VORLAX  1413
      RETURN                                                            VORLAX  1414
      END                                                               VORLAX  1415
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        SUBROUTINE GEOM       74/74    OPT=1                         FTN 4.5+410A       10/04/76  10.15.13        PAGE      7

 CARD NR. SEVERITY  DETAILS    DIAGNOSIS OF PROBLEM

      313      I               AN IF STATEMENT MAY BE MORE EFFICIENT THAN A 2 OR 3 BRANCH COMPUTED GO TO STATEMENT.
      325      I               AN IF STATEMENT MAY BE MORE EFFICIENT THAN A 2 OR 3 BRANCH COMPUTED GO TO STATEMENT.



        SYMBOLIC REFERENCE MAP (R=1)

  ENTRY POINTS
      3   GEOM

  VARIABLES       SN  TYPE               RELOCATION
   1440   AINC1       REAL        ARRAY     SET4             1444   AINC2       REAL        ARRAY     SET4
    334   ALOC        REAL        ARRAY     SET6              601   COL         REAL
      0   CHORD       REAL        ARRAY     SET10             560   COD         REAL
    565   CODIF       REAL                                    430   CSTART      REAL        ARRAY     SET5
      0   CX          INTEGER     ARRAY     SET3                0   DCP         REAL        ARRAY     SET2
    545   DELTA       REAL                                    563   DINC        REAL
    144   DL          REAL        ARRAY     SET10               0   DNDX1       REAL        ARRAY     SET4
    620   DNDX2       REAL        ARRAY     SET4              576   DNORM       REAL
    561   DTJ         REAL                                    534   DTR         REAL
    546   ETA         REAL                                     12   FLOATX      REAL                  / /
     13   FLOATY      REAL                  / /               564   FRC         REAL
      0   GAMMA       REAL        ARRAY     SET16              11   MAG         REAL                  / /
     24   HEAD        REAL        ARRAY     SET6              542   I           INTEGER
    543   ICYCLE      INTEGER                               13560   IDES        INTEGER     ARRAY     SET13
      3   IH          INTEGER               / /               404   INTRAC      INTEGER     ARRAY     SET20
     14   INVERS      INTEGER               / /               577   INX         INTEGER
   1130   IPAN        INTEGER     ARRAY     SET10               2   IQ          INTEGER               / /
    360   IQUANT      INTEGER     ARRAY     SET5              535   IR          INTEGER
    536   IRR         INTEGER                                 600   ISENC       INTEGER
      0   ITOTAL      INTEGER                F.P.             170   ITS         INTEGER     ARRAY     SET7
    556   J           INTEGER                                 214   JTS         INTEGER     ARRAY     SET7
    544   JUMP        INTEGER                                 570   K           INTEGER
    537   KED         INTEGER                                 571   KEDK        INTEGER
    554   KEDOR       INTEGER                                 540   KEG         INTEGER
    572   KEGK        INTEGER                                 574   KEGK2       INTEGER
    555   KEGOR       INTEGER                                 603   L           INTEGER
      4   LATRAL      INTEGER               / /                 0   LAX         INTEGER               / /
      1   LAY         INTEGER               / /               240   LESWF       REAL        ARRAY     SET5
    566   MAX         INTEGER                                 575   NCORC       INTEGER
      0   NPAN        INTEGER               SET14               3   NPANAS      INTEGER               SET14
    360   NPP         INTEGER     ARRAY     SET20               1   NT          INTEGER               SET14
    550   NV          INTEGER                                 620   NVOR        REAL        ARRAY     SET5
   3720   ONSET       REAL        ARRAY     SET16             170   POL         REAL        ARRAY     SET5
     50   PHIMED      REAL        ARRAY     SET20             533   PI          REAL
    567   PION        REAL                                      6   PITCHW      REAL                  / /
      5   PSI         REAL                  / /               550   PSPAN       REAL        ARRAY     SET5
    214   RCS         REAL        ARRAY     SET20            7640   RFLAG       REAL        ARRAY     SET13
    573   RK          REAL                                      0   RNCV        REAL        ARRAY     SET7
     24   RNMAX       REAL        ARRAY     SET7                7   ROLLG       REAL                  / /
    602   SDL         REAL                                    547   SID         REAL
    541   SIGN        REAL                                     50   SLE         REAL        ARRAY     SET19
      0   SLE1        REAL        ARRAY     SET19              24   SLE2        REAL        ARRAY     SET19
   3720   SLOPE       REAL        ARRAY     SET2                2   SMAX        REAL                  SET14
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        SUBROUTINE GEOM       74/74    OPT=1                          FTN 4.5+410A       10/04/76  10.15.13       PAGE      8

 VARIABLES      SN  TYPE             RELOCATION
   3720  SX          INTEGER    ARRAY     SET3             310  SYNTH      REAL          ARRAY     SET5
    547  TAD         REAL                                  500  TAPER      REAL          ARRAY     SET5
      0  TITLE       INTEGER    ARRAY     SET6             454  TNL        REAL          ARRAY     SET10
    620  TNT         REAL       ARRAY     SET10            604  VUREX      REAL
   7640  VSP         REAL       ARRAY     SET2             310  VSS        REAL          ARRAY     SET10
  10270  VST         REAL       ARRAY     SET20              0  X          REAL          ARRAY     SET1
      0  XAPEX       REAL       ARRAY     SET5             562  XLE        REAL
    551  XNOT        REAL                                  764  XTE        REAL          ARRAY     SET10
   3720  Y           REAL       ARRAY     SET1              50  YAPEX      REAL          ARRAY     SET5
     10  YAWQ        REAL                 / /              552  YNOT       REAL
    430  YY          REAL       ARRAY     SET20           4064  Z          REAL          ARRAY     SET1
    120  ZAPEX       REAL       ARRAY     SET5            4230  ZC         REAL          ARRAY     SET1
    214  ZETA        REAL       ARRAY     SET19              0  ZLE1       REAL          ARRAY     SET20
     24  ZLE2        REAL       ARRAY     SET20            553  ZNOT       REAL
   4350  ZZ          REAL       ARRAY     SET20

 EXTERNALS           TYPE    ARGS
         COS         REAL      1 LIBRARY                        SIN        REAL          1 LIBRARY
         SQRT        REAL      1 LIBRARY                        TAN        REAL          1 LIBRARY

 INLINE FUNCTIONS    TYPE    ARGS
         ABS         REAL      1  INTRIN                        FLOAT      REAL          1  INTRIN

 STATEMENT LABELS
     17  10                                     0  20          INACTIVE             142  30
    211  40                                   241  50                               322  60
    331  70                                     0  80                                 0  90          INACTIVE
    353  100                                  377  110                              421  120
    430  130                                  437  140                              457  150
    462  160                                  470  170                              510  180
      0  190

 LOOPS  LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
    44  80      * J          132 264      272B                 EXT REFS  NOT INNER
   232  70      * K          233 261      102B                 EXT REFS
   404  190     * IR         308 335      111B                 EXT REFS  NOT INNER
   440  180     * L          319 334       53B                 EXT REFS

 COMMON BLOCKS    LENGTH
         / /          13
         SET1       2250
         SET2       6000
         SET3       8000
         SET4        840
         SET5        440
         SET6       2220
         SET7        240
         SET10       700
         SET14         4
         SET16      4000
         SET19       240
         SET20      6280

 STATISTICS
   PROGRAM LENGTH                      605B       389
   CM LABELED COMMON LENGTH          74756B     31214
   CM BLANK COMMON LENGTH                15B        13
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      CONTROL*VRLX.INPUT                                          9/16/76  VORLAX    1416
C...                                                                       VORLAX    1417
      SUBROUTINE INPUT                                                     VORLAX    1418
C...                                                                       VORLAX    1419
C...PURPOSE    TO READ IN INPUT DATA AND PREPARE SUCH DATA FOR             VORLAX    1420
C...           USE IN THE GENERATION OF VORTEX LATTICE GEOMETRY            VORLAX    1421
C...           TO BE DONE IN SUBROUTINE GEOM.                              VORLAX    1422
C...                                                                       VORLAX    1423
C...INPUT      CALLING SEQUENCES                                           VORLAX    1424
C...           NONE.                                                       VORLAX    1425
C...           COMMONS                                                     VORLAX    1426
C...           LAX.                                                        VORLAX    1427
C...                                                                       VORLAX    1428
C...OUTPUT     CALLING SEQUENCES                                           VORLAX    1429
C...           NONE.                                                       VORLAX    1430
C...           COMMONS                                                     VORLAX    1431
C...           DL, XS, ITS, NPP, NXS, NYS, NZS, PDL, PSI, RCS,             VORLAX    1432
C...           SPC, VSS, CBAR, HEAD, MACH, NPAN, NVOR, RNCV, SLE1,         VORLAX    1433
C...           SLE2, SREF, VINF, XBAR, YAWQ, YNOT, ZBAR, ZLE1,             VORLAX    1434
C...           ZLE2, ZNOT, AINC1, AINC2, ALPHA, DNDX1, DNDX2,              VORLAX    1435
C...           GAMMA, LESWP, NMACH, PSPAN, ROLLQ, SYNTH, TAPER,            VORLAX    1436
C...           WSPAN, XAPEX, YAPEX, ZAPEX, CSTART, DELTAY, DELTAZ,         VORLAX    1437
C...           INTRAC, INVERS, IQUANT, LATRAL, NALPHA, PHIMED,             VORLAX    1438
C...           PITCHQ.                                                     VORLAX    1439
C...                                                                       VORLAX    1440
C...SUBROUTINES                                                            VORLAX    1441
C...CALLED     NONE.                                                       VORLAX    1442
C...                                                                       VORLAX    1443
C...DISCUSSION A MASTER FRAME OF REFERENCE IS ASSUMED IN DEFINING          VORLAX    1444
C...           A CONFIGURATION. THIS FRAME OF REFERENCE IS AN              VORLAX    1445
C...           ORTHOGONAL CARTESIAN COORDINATE SYSTEM, THE X-Z             VORLAX    1446
C...           BEING THE CENTERLINE PLANE WITH THE X-AXIS POINTING         VORLAX    1447
C...           DOWNSTREAM, AND THE Z-AXIS DIRECTED UPWARD, THE             VORLAX    1448
C...           Y-AXIS POINTS TO STARBOARD. THE ORIGIN OF THE SYS           VORLAX    1449
C...           TEM CAN BE ANY CONVEVIENT POINT IN THE X-Z PLANE.           VORLAX    1450
C...           THE CONFIGURATION CAN BE MADE UP OF SYMMETRICAL             VORLAX    1451
C...           (ABOUT THE X-Z PLANE) AND/OR ASYMMETRICAL COMPO-            VORLAX    1452
C...           NENTS, AND IN DEFINING THE SYMMETRICAL COMPONENTS           VORLAX    1453
C...           ONLY THE STARBOARD ELEMENTS ARE SPECIFIED. THE              VORLAX    1454
C...           CONFIGURATION TO BE INPUT IS DIVIDED INTO A SET             VORLAX    1455
C...           OF MAJOR PANELS, UP TO 20 OF THESE PANELS CAN BE            VORLAX    1456
C...           INPUT, SYMMETRICAL COMPONENTS (LEFT + RIGHT) BEING          VORLAX    1457
C...           COUNTED ONLY ONCE. FOR INSTANCE, A WING OF ZERO             VORLAX    1458
C...           THICKNESS AND WITH STRAIGHT LEADING AND TRAILING            VORLAX    1459
C...           EDGES, AND WITH LINEAR LOFTING BETWEEN ROOT AND             VORLAX    1460
C...           TIP, CONSTITUTES A MAJOR PANEL. COMPLEX PLANFORMS,          VORLAX    1461
C...           AND NON-LINEAR CHANGES IN TWIST AND AIRFOIL SECTIONS        VORLAX    1462
C...           ARE DESCRIBED BY DEFINING MORE THAN ONE PANEL FOR A         VORLAX    1463
C...           GIVEN WING. SUBROUTINE INPUT PREPARES THE DATA SPE          VORLAX    1464
C...           CIFIED FOR EACH MAJOR PANEL SO THAT THEY CAN LATER          VORLAX    1465
C...           BE USED IN SUBROUTINE GEOM TO GENERATE THE PROPER           VORLAX    1466
C...           VORTEX LATTICE FOR EACH PANEL.                              VORLAX    1467
C...           AN AIRFOIL WITH THICKNESS CAN BE REPRESENTED BY A           VORLAX    1468
C...           DOUBLE VORTEX SHEET, I. E., BY DEFINING TWO MAJOR PA        VORLAX    1469
C...           NELS ARRANGED IN A #BIPLANE#, OR #SANDWICH#, FASHION,       VORLAX    1470
C...           ONE PANEL REPRESENTING THE UPPER SURFACE OF THE AIR         VORLAX    1471
C...           FOIL, AND THE OTHER PANEL REPRESENTING THE LOWER            VORLAX    1472
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C...            SURFACE OF THE SAME AIRFOIL.                            VORLAX    1473
C...            FUSIFORM BODIES ARE MODELLED BY DEFINING AN AUXILIARY   VORLAX    1474
C...            BODYIDENTICAL IN CROSS-SECTIONAL SHAPE AND LONGITUDI    VORLAX    1475
C...            NAL AREA DISTRIBUTION TO THE ACTUAL BODY BUT WITHOUT    VORLAX    1476
C...            CAMBER. THE AUXILIARY BODY CROSS-SECTION IS APPROXI     VORLAX    1477
C...            MATED BY A POLYGON WHOSE SIDES DETERMINE THE TRANS      VORLAX    1478
C...            VERSE LEGS OF THE HORSESHOE VORTICES. THE VERTICES      VORLAX    1479
C...            OF THE POLYGON AND THE AUXILIARY BODY AXIS DEFINE       VORLAX    1480
C...            A SET OF RADIAL PLANES IN WHICH THE BOUND TRAILING      VORLAX    1481
C...            LEGS OF THE HORSESHOE VORTICES LIE PARALLEL TO THE      VORLAX    1482
C...            AXIS. AS THE CROSS-SECTION CHANGES SHAPE ALONG THE      VORLAX    1483
C...            AXIS, THE POLYGON CHANGES ACCORDINGLY BUT WITH THE      VORLAX    1484
C...            CONSTRAINT THAT THE POLYGONAL VERTICES MUST ALWAYS      VORLAX    1485
C...            LIE IN THE SAME SET OF RADIAL PLANES. THE BODY CAMBER   VORLAX    1486
C...            IS SPECIFIED INDEPENDENTLY.                             VORLAX    1487
C...                                                                    VORLAX    1488
C...                                                                    VORLAX    1489
C...                                                                    VORLAX    1490
      DIMENSION C1 (50), C2 (50), RO (51), PHI (51)                     VORLAX    1491
      DIMENSION XAF (50), ZC1 (50), ZC2 (50)                            VORLAX    1492
      DIMENSION DESCRP (10)                                             VORLAX    1493
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                              VORLAX    1494
      INTEGER TITLE, CX, SX                                             VORLAX    1495
      COMMON LAX, LAY, IQ, IM, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,   VORLAX    1496
     * FLOATX, FLOATY, INVERS, ISOLV                                    VORLAX    1497
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (20)                 VORLAX    1498
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                VORLAX    1499
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)     VORLAX    1500
      COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20)    VORLAX    1501
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),       VORLAX    1502
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),    VORLAX    1503
     * PSPAN (40), NVOR (40)                                            VORLAX    1504
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                 VORLAX    1505
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)         VORLAX    1506
      COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),         VORLAX    1507
     * CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),            VORLAX    1508
     * RM (40), CRM (40), YM (40), CYM (40), ASUC (40), SURF (40)       VORLAX    1509
      COMMON /SET9 /CDC (100), CNC (100)                                VORLAX    1510
      COMMON /SET10 /CHORD (100), UL (100), VSS (100), TNL (100),       VORLAX    1511
     * TNT (100), XTE (100), IPAN (100)                                 VORLAX    1512
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA     VORLAX    1513
      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT     VORLAX    1514
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, RLM                VORLAX    1515
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                            VORLAX    1516
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                         VORLAX    1517
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                    VORLAX    1518
      COMMON /SET17 /CSUC (100), CNTC (100), SPC (40)                   VORLAX    1519
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20) VORLAX    1520
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)        VORLAX    1521
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),     VORLAX    1522
     * NPP (20), INTRAC (20), YY (2000), ZZ (2000), VST(2000)           VORLAX    1523
C                                                                       VORLAX    1524
      PI = 3.14159                                                      VORLAX    1525
      DTR = 0.01745329                                                  VORLAX    1526
C                                                                       VORLAX    1527
C...FLIGHT CONDITIONS AND CONFIGURATION REFERENCE PARAMETERS ARE        VORLAX    1528
C...ARE READ IN FIRST.                                                  VORLAX    1529
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C                                                                       VORLAX  1530
      READ (5, 10) NMACH, (MACH (I), I = 1, NMACH)                      VORLAX  1531
      WRITE (6, 20) NMACH, (MACH (I), I = 1, NMACH)                     VORLAX  1532
   10 FORMAT (I2, 8X, 7F10.0)                                           VORLAX  1533
   20 FORMAT (1H0 , I2, 8X, 7F10.3)                                     VORLAX  1534
C...                                                                    VORLAX  1535
C...                                                                    VORLAX  1536
C...                                                                    VORLAX  1537
      READ (5, 10) NALPHA, (ALPHA (I) , I = 1, NALPHA)                  VORLAX  1538
      WRITE (6, 20) NALPHA, (ALPHA (I) , I = 1, NALPHA)                 VORLAX  1539
C...                                                                    VORLAX  1540
C...                                                                    VORLAX  1541
C...                                                                    VORLAX  1542
      READ (5, 10) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF               VORLAX  1543
      IF (PSI .NE. 0.) LATRAL = 1                                       VORLAX  1544
      IF (ROLLQ .NE. 0.) LATRAL = 1                                     VORLAX  1545
      IF (YAWQ .NE. 0.) LATRAL = 1                                      VORLAX  1546
      IF (VINF .LE. 0.001) VINF = 1.0                                   VORLAX  1547
      WRITE (6, 20) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF              VORLAX  1548
C...                                                                    VORLAX  1549
C...                                                                    VORLAX  1550
      READ (5, 30) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN                  VORLAX  1551
   30 FORMAT (I2, 8X, 5F10.0)                                           VORLAX  1552
   40 FORMAT (1H0 , I2, 8X, F10.2, 4F10.4)                              VORLAX  1553
      IF (WSPAN .LE. 0.0001) WSPAN = 2.0                                VORLAX  1554
      WRITE (6, 40 ) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN                VORLAX  1555
   50 FORMAT (8F10.0)                                                   VORLAX  1556
   60 FORMAT (1H , 4 (F10.2, F10.4))                                    VORLAX  1557
C                                                                       VORLAX  1558
C...                                                                    VORLAX  1559
C...                                                                    VORLAX  1560
      INVERS = 0                                                        VORLAX  1561
      KED = 0                                                           VORLAX  1562
      KEG = 0                                                           VORLAX  1563
      KEGR = 0                                                          VORLAX  1564
C...                                                                    VORLAX  1565
C...THE DO-LOOP ENDED BY LABEL 365 READS IN THE COMPLETE DEFINITION     VORLAX  1566
C...OF EACH MAJOR PANEL MAKING UP THE CONFIGURATION, THERE BEING        VORLAX  1567
C...NPAN SUCH PANELS.                                                   VORLAX  1568
C...                                                                    VORLAX  1569
C...                                                                    VORLAX  1570
      DO 390 I = 1, NPAN                                                VORLAX  1571
      WRITE (6, 70 ) I                                                  VORLAX  1572
   70 FORMAT (1H0, 10H**********, I3, 11H **********)                   VORLAX  1573
   80 FORMAT (1H , 8F10.4)                                              VORLAX  1574
C...                                                                    VORLAX  1575
C...DEFINE STREAMWISE EDGES (2) OF PANEL BY SPECIFYING COORDINATES      VORLAX  1576
C...OF LEADING EDGES (X1, Y1, Z1, X2, Y2, Z2) AND CHORD LENGTHS         VORLAX  1577
C...(CORD1, CORD2). CHORD LENGTHS ARE MEASURED PARALLEL TO X-AXIS.      VORLAX  1578
C...DESCRP IS ANY PANEL IDENTIFICATION LABEL.                           VORLAX  1579
C...                                                                    VORLAX  1580
      READ (5, 100) X1, Y1, Z1, CORD1, DESCRP                           VORLAX  1581
C                                                                       VORLAX  1582
C...SAVE PANEL DESCRIPTION INFORMATION FOR IDENTIFICATION IN            VORLAX  1583
C...PRINTOUT OF DATA IN SUBROUTINE PRINT.                               VORLAX  1584
C                                                                       VORLAX  1585
      ISTART = (I - 1) *10                                              VORLAX  1586
      DO 90 IL = 1, 10                                                  VORLAX 1587
      IM = ISTART + IL                                                  VORLAX 1588
      HEAD (IM) = DESCRP (IL)                                           VORLAX 1589
   90 CONTINUE                                                          VORLAX 1590
C                                                                       VORLAX 1591
      WRITE (6, 110) X1, Y1, Z1, CORD1, DESCRP                          VORLAX 1592
      READ (5, 100) X2, Y2, Z2, CORD2, DESCRP                           VORLAX 1593
      WRITE (6, 110) X2, Y2, Z2, CORD2, DESCRP                          VORLAX 1594
C...                                                                    VORLAX 1595
C...DEFINE PANEL VORTEX LATTICE DENSITY BY SPECIFYING SPANWISE          VORLAX 1596
C...(NVOR) AND CHORDWISE (RNCV) NUMBERS OF HORSESHOE VORTICES.          VORLAX 1597
C...ALSO SPECIFY LEADING EDGE SUCTION CHARACTERISTICS FOR PANEL         VORLAX 1598
C...(SPC) AND PANEL LATERAL (OR SPANWISE) CURVATURE (OR SHAPE)          VORLAX 1599
C...CHARACTERISTIC (PDL).                                               VORLAX 1600
C...                                                                    VORLAX 1601
      READ (5, 100) NVOR (I), RNCV (I), SPC (I), PDL (I), DESCRP        VORLAX 1602
      WRITE (6, 110) NVOR (I), RNCV (I), SPC (I), PDL (I), DESCRP       VORLAX 1603
C...                                                                    VORLAX 1604
C...                                                                    VORLAX 1605
C...PARAMETER INTRAC INDICATES WHETHER PANEL IS STRAIGHT IN THE         VORLAX 1606
C...LATERAL (OR SPANWISE) DIRECTION (INTRAC = 0), OR CURVED             VORLAX 1607
C...(POLYGONALLY SEGMENTED) IN SAME DIRECTION (INTRAC = 1).             VORLAX 1608
C...                                                                    VORLAX 1609
C...                                                                    VORLAX 1610
      INTRAC (I) = 1                                                    VORLAX 1611
      IF (PDL (I) .EQ. 0.0) INTRAC (I) = 0                              VORLAX 1612
  100 FORMAT (4F10.0, 10A4)                                             VORLAX 1613
  110 FORMAT (1H , 4F10.4, 10A4)                                        VORLAX 1614
      XAPEX (I) = X1                                                    VORLAX 1615
      YAPEX (I) = Y1                                                    VORLAX 1616
      ZAPEX (I) = Z1                                                    VORLAX 1617
      CSTART (I) = CORD1                                                VORLAX 1618
      DELTAY = Y2 - Y1                                                  VORLAX 1619
      DELTAZ = Z2 - Z1                                                  VORLAX 1620
C...                                                                    VORLAX 1621
C...IF PANEL IS LATERALLY FLAT (INTRAC = 0) THEN MAKE PDL EQUAL         VORLAX 1622
C...TO PANEL DIHEDRAL AND COMPUTE PANEL SPAN (PSPAN) AND LEADING        VORLAX 1623
C...EDGE SWEEP.                                                         VORLAX 1624
C...                                                                    VORLAX 1625
C...                                                                    VORLAX 1626
C...                                                                    VORLAX 1627
      IF (INTRAC (I) .EQ. 0) PDL (I) = 1. /DTR *ATAN2 (DELTAZ, DELTAY)  VORLAX 1628
      IF (INTRAC (I) .EQ. 0) PSPAN (I) = SQRT (DELTAY **2 + DELTAZ **2) VORLAX 1629
      DELTAX = X2 - X1                                                  VORLAX 1630
      IF(INTRAC (I) .EQ. 0) LESWP (I) = 1./DTR*ATAN2 (DELTAX, PSPAN(I)) VORLAX 1631
      TAPER (I) = CORD2 /CORD1                                          VORLAX 1632
C...                                                                    VORLAX 1633
C...                                                                    VORLAX 1634
C...IF PANEL IS LATERALLY CURVED OR SEGMENTED (INTRAC = 1) THEN         VORLAX 1635
C...DETERMINE THE VALUE OF LATERAL (OR SPANWISE) INDEX (EQUIVALENT      VORLAX 1636
C...TO SX, SEE SUBROUTINE GEOM) OF ITS FIRST STREAMWISE STRIP OR        VORLAX 1637
C...ROW OF VORTICES, IBOT.                                              VORLAX 1638
C...                                                                    VORLAX 1639
C...                                                                    VORLAX 1640
      IF ( INTRAC (I) .EQ. 0) GO TO 150                                 VORLAX 1641
      NV = NVOR (I)                                                     VORLAX 1642
      IBOT = 1                                                          VORLAX 1643
      IF (I .EQ. 1) GO TO 130                                           VORLAX  1644
      ITOP = I - 1                                                      VORLAX  1645
      DO 120 J = 1, ITOP                                                VORLAX  1646
      INV = NVOR (J)                                                    VORLAX  1647
      IBOT = IBOT + INV                                                 VORLAX  1648
  120 CONTINUE                                                          VORLAX  1649
C...                                                                    VORLAX  1650
C...                                                                    VORLAX  1651
C...READ IN POLAR COORDINATES OF CONTROL SURFACE CYLINDER CROSS         VORLAX  1652
C...SECTION, OR AUXILIARY BODY MASTER CROSS-SECTION. ONLY               VORLAX  1653
C...APPLICABLE IF INTRAC = 1.                                           VORLAX  1654
C...                                                                    VORLAX  1655
C...                                                                    VORLAX  1656
  130 ITOP = IBOT + NV - 1                                              VORLAX  1657
      JJTOP = NVOR (I) + 1                                              VORLAX  1658
      READ (5, 50) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)                   VORLAX  1659
      WRITE (6, 60) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)                  VORLAX  1660
      PSPAN (I) = 0.0                                                   VORLAX  1661
C...                                                                    VORLAX  1662
C...                                                                    VORLAX  1663
C...COMPUTE CROSS-SECTIONAL PARAMETERS OF CONTROL SURFACE CYLINDER      VORLAX  1664
C...OR AUXILIARY BODY.                                                  VORLAX  1665
C...                                                                    VORLAX  1666
C...                                                                    VORLAX  1667
      DO 140 IR = IBOT, ITOP                                            VORLAX  1668
      JJ = IR - IBOT + 1                                                VORLAX  1669
      DELTAZ = RO (JJ + 1) *SIN (DTR*PHI(JJ+ 1)) - RO (JJ) *            VORLAX  1670
     * SIN (DTR * PHI (JJ))                                             VORLAX  1671
      DELTAY = RO (JJ + 1) *COS (DTR*PHI(JJ + 1)) - RO (JJ) *           VORLAX  1672
     * COS (DTR * PHI (JJ))                                             VORLAX  1673
      DL (IR) = 1. /DTR *ATAN2 (DELTAZ, DELTAY)                         VORLAX  1674
      DMZ = RO (JJ) * SIN (DTR*PHI (JJ)) + 0.5 * DELTAZ                 VORLAX  1675
      DMY = RO (JJ) * COS (DTR * PHI (JJ)) + 0.5 * DELTAY               VORLAX  1676
      PHIMED (IR) = ATAN2 (DMZ, DMY) /DTR                               VORLAX  1677
      RCS (IR) = SQRT (DMY **2 + DMZ **2)                               VORLAX  1678
      VSS (IR) = 0.5 *SQRT (DELTAY **2 + DELTAZ **2)                    VORLAX  1679
      PSPAN (I) = PSPAN (I) + 2.0 *VSS (IR)                             VORLAX  1680
  140 CONTINUE                                                          VORLAX  1681
C...                                                                    VORLAX  1682
C...                                                                    VORLAX  1683
      LESWP (I) = 1. /DTR *ATAN2 (DELTAX, PSPAN (I))                    VORLAX  1684
C...                                                                    VORLAX  1685
C...                                                                    VORLAX  1686
C...CONTINUE READING IN DATA APPLICABLE TO BOTH INTRAC = 0 AND          VORLAX  1687
C...INTRAC = 1.                                                         VORLAX  1688
C...                                                                    VORLAX  1689
C...                                                                    VORLAX  1690
  150 READ(5,160) AINC1(I),AINC2(I),ITS(I),NAP,IQUANT(I),ISYNT,NPP(I)   VORLAX  1691
C...                                                                    VORLAX  1692
C...MAKE APPROPIATE INPUT PARAMETERS COMPATIBLE WITH PANEL CHARAC       VORLAX  1693
C...TERISTICS TO PREVENT EXECUTION ERRORS.                              VORLAX  1694
C...                                                                    VORLAX  1695
      IF (INTRAC (I) .EQ. 1 .AND. NAP .LT. 3) NPP (I) = 0               VORLAX  1696
      IF (IQUANT (I) .EQ. 0) IQUANT (I) = 2                             VORLAX  1697
      IF (IQUANT (I) .EQ. 1) LATRAL = 1                                 VORLAX  1698
C...                                                                    VORLAX  1699
      WRITE(6,170) AINC1(I),AINC2(I),ITS(I),NAP,IQUANT(I),ISYNT,NPP(I)  VORLAX  1700
      C...                                                              VORLAX   1701
        160  FORMAT (2F10.0, 5 (I2, 8X))                                VORLAX   1702
        170  FORMAT (1H , 2F10.4, 5 (I2, 8X))                           VORLAX   1703
      C...                                                              VORLAX   1704
             SYNTH (I) = ISYNT                                          VORLAX   1705
             MAX = RNCV (I)                                             VORLAX   1706
             ZLE1 (I) = 0.0                                             VORLAX   1707
             ZLE2 (I) = 0.0                                             VORLAX   1708
      C...                                                              VORLAX   1709
      C...CLEAR OUT APPROPIATE SECTION OF ARRAY GAMMA WHICH IS TO BE    VORLAX   1710
      C...USED AS TEMPORARY INPUT DATA STORAGE FOR LATER MANIPULATION   VORLAX   1711
      C...IN SUBROUTINE GEOM.                                           VORLAX   1712
      C...                                                              VORLAX   1713
             DO 180 L1 = 1, MAX                                         VORLAX   1714
             KEG = KEG + 1                                              VORLAX   1715
             KEG2 = KEG + MAX                                           VORLAX   1716
             GAMMA (KEG) = 0.0                                          VORLAX   1717
             GAMMA (KEG2) = 0.0                                         VORLAX   1718
        180  CONTINUE                                                   VORLAX   1719
      C...                                                              VORLAX   1720
      C...                                                              VORLAX   1721
      C...IF PANEL SURFACE WARP WILL NOT BE DESIGNED (ANALYSIS CASE)    VORLAX   1722
      C...THEN BYPASS READING IN OF LOAD COEFFICIENTS.                  VORLAX   1723
      C...                                                              VORLAX   1724
      C...                                                              VORLAX   1725
             IF (ISYNT .EQ. 0) GO TO 190                                VORLAX   1726
             READ (5, 50) (C1 (K), K = 1, MAX)                          VORLAX   1727
             WRITE (6, 80) (C1 (K), K = 1, MAX)                         VORLAX   1728
             READ (5, 50) (C2 (K), K = 1, MAX)                          VORLAX   1729
             WRITE (6, 80) (C2 (K), K = 1, MAX)                         VORLAX   1730
      C...                                                              VORLAX   1731
      C...INVERS INDICATES WHETHER THERE IS ONE (OR MORE) PANEL IN THE  VORLAX   1732
      C...CONFIGURATION WHICH IS TO BE DESIGNED IN TERMS OF SURFACE WARP. VORLAX 1733
      C...INVERS = 1 S CAMBER DESIGN REQUIRED FOR ONE OR MORE PANELS.   VORLAX   1734
      C...INVERS = 0 S NO PANEL IS TO BE DESIGNED.                      VORLAX   1735
      C...                                                              VORLAX   1736
             INVERS = 1                                                 VORLAX   1737
             SLE1 (I) = 0.                                              VORLAX   1738
             SLE2 (I) = 0.                                              VORLAX   1739
             GO TO 300                                                  VORLAX   1740
      C...                                                              VORLAX   1741
      C...                                                              VORLAX   1742
      C...IF PANEL IS A FLAT PLATE THEN SKIP READING OF PANEL CAMBER    VORLAX   1743
      C...DEFINITION DATA. IF NAP .LT. 3 PANEL IS ASSUMED TO BE FLAT .  VORLAX   1744
      C...                                                              VORLAX   1745
      C...                                                              VORLAX   1746
        190  IF (NAP .LT. 3) GO TO 280                                  VORLAX   1747
      C                                                                 VORLAX   1748
      C...IF PANEL IS EITHER UPPER SURFACE OR LOWER SURFACE OF AN AIRFOIL VORLAX 1749
      C...(ILE .EQ. 1 .OR. ILE .EQ. - 1) THEN THE CORRESPONDING LEADING VORLAX   1750
      C...EDGE RADII (RLE1, RLE2) HAVE TO BE READ IN.                   VORLAX   1751
      C...                                                              VORLAX   1752
             ILE = ITS (I) *(1 - INTRAC (I))                            VORLAX   1753
             READ (5, 50) (XAF (JJ), JJ = 1, NAP)                       VORLAX   1754
             WRITE (6, 80) (XAF (JJ), JJ = 1, NAP)                      VORLAX   1755
             RLE1 = 0.0                                                 VORLAX   1756
             RLE2 = 0.0                                                 VORLAX   1757
      IF (ILE .NE. 0)  READ (5, 50) RLE1                                VORLAX  1758
      IF (ILE .NE. 0) WRITE (6, 80) RLE1                                VORLAX  1759
      READ (5, 50) (ZC1 (JJ), JJ = 1, NAP)                              VORLAX  1760
      WRITE (6, 80) (ZC1 (JJ) , JJ = 1, NAP)                            VORLAX  1761
      IF (ILE .NE. 0) READ (5, 50) RLE2                                 VORLAX  1762
      IF (ILE .NE. 0) WRITE (6, 80) RLE2                                VORLAX  1763
      READ (5, 50) (ZC2 (JJ), JJ = 1, NAP)                              VORLAX  1764
      WRITE (6, 80) (ZC2 (JJ), JJ = 1, NAP)                             VORLAX  1765
      ZLE1 (I) = ZC1 (1)                                                VORLAX  1766
      ZLE2 (I) = ZC2 (1)                                                VORLAX  1767
C                                                                       VORLAX  1768
C                                                                       VORLAX  1769
      JC = 2                                                            VORLAX  1770
      MAXIM = MAX + 1                                                   VORLAX  1771
C...                                                                    VORLAX  1772
C...THE DO-LOOP ENDED BY LABEL 270 COMPUTES THE SLOPE OF THE            VORLAX  1773
C...SURFACE AT THE CORRESPONDING CONTROL POINTS ALONG THE               VORLAX  1774
C...STREAMWISE EDGES OF THE PANEL. THESE SLOPES ARE STORED IN           VORLAX  1775
C...ARRAYS DNDX1 (EDGE 1) AND DNDX2 (EDGE 2). THE SLOPE COMPUTATION     VORLAX  1776
C...IS DONE BY USING 3-POINT LAGRANGE POLYNOMIALS. IF ILE .NE. 0        VORLAX  1777
C...THEN SQUARE ROOT TYPE LAGRANGE POLYNOMIAL IS USED FOR THE           VORLAX  1778
C...COMPUTATION OF SLOPE NEAR THE LEADING EDGE.                         VORLAX  1779
C...                                                                    VORLAX  1780
      DO 270 JJX = 1, MAXIM                                             VORLAX  1781
      JX = JJX - 1                                                      VORLAX  1782
      IF (LAX .EQ. 1) GO TO 200                                         VORLAX  1783
      XX = (1. - COS (PI *FLOAT (JX) /RNCV (I))) *50.0                  VORLAX  1784
      GO TO 210                                                         VORLAX  1785
  200 XX = (FLOAT (JX) - 0.25) /RNCV (I) *100.0                         VORLAX  1786
      IF (XX .LT. 0.) XX = 0.                                           VORLAX  1787
  210 IF (XX .GE. XAF (JC - 1) .AND. XX .LE. XAF (JC)) GO TO 220        VORLAX  1788
      IF (JC .EQ. (NAP - 1)) GO TO 220                                  VORLAX  1789
      JC = JC + 1                                                       VORLAX  1790
      GO TO 210                                                         VORLAX  1791
  220 XX1 = XAF (JC - 1)                                                VORLAX  1792
      XX2 = XAF (JC)                                                    VORLAX  1793
      XX3 = XAF (JC + 1)                                                VORLAX  1794
      D1 = (XX1 - XX2) *(XX1 - XX3)                                     VORLAX  1795
      D2 = (XX2  - XX3) *(XX2 - XX1)                                    VORLAX  1796
      D3 = (XX3 - XX1) *(XX3 - XX2)                                     VORLAX  1797
      P1 = (XX2 + XX3) /D1                                              VORLAX  1798
      P2 = (XX3 + XX1) /D2                                              VORLAX  1799
      P3 = (XX1 + XX2) /D3                                              VORLAX  1800
      VI1 = ZC1 (JC - 1)                                                VORLAX  1801
      VI2 = ZC1 (JC)                                                    VORLAX  1802
      VI3 = ZC1 (JC + 1)                                                VORLAX  1803
      VO1 = ZC2 (JC - 1)                                                VORLAX  1804
      VO2 = ZC2 (JC)                                                    VORLAX  1805
      VO3 = ZC2 (JC + 1)                                                VORLAX  1806
      IF (ILE .EQ. 0 .OR. JC .GT. 2) GO TO 240                          VORLAX  1807
      IF (XX .LE. 0.0) GO TO 230                                        VORLAX  1808
C                                                                       VORLAX  1809
      SIGN1 = 1.0                                                       VORLAX  1810
      SIGN2 = 1.0                                                       VORLAX  1811
      IF (VI2 .LT. VI1) SIGN1 = -1.0                                    VORLAX  1812
      IF (VO2 .LT. VO1) SIGN2 = -1.0                                    VORLAX  1813
      BIAO = SIGN1 *SQRT (2.0 *RLE1)                                    VORLAX  1814
      B2A0 = SIGN2 *SQRT (2.0 *RLE2)
      B1C2 = VI2 - B1A0 *SQRT (XX2) - VI1
      B2C2 = VO2 - B2A0 *SQRT (XX2) - VO1
      B1C3 = VI3 - B1A0 *SQRT (XX3) - VI1
      B2C3 = VO3 - B2A0 *SQRT (XX3) - VO1
      B1A1 = (B1C2 *XX3 /XX2 - B1C3 *XX2 /XX3) /(XX3 - XX2)
      B2A1 = (B2C2 *XX3 /XX2 - B2C3 *XX2 /XX3) /(XX3 - XX2)
      B1A2 = (B1C2 /XX2 - B1C3 /XX3) /(XX2 - XX3)
      B2A2 = (B2C2 /XX2 - B2C3 /XX3) /(XX2 - XX3)
      C1VAL = 0.5 *B1A0 /SQRT (XX) + B1A1 + 2. *B1A2 *XX
      C2VAL = 0.5 *B2A0 /SQRT (XX) + B2A1 + 2. *B2A2 *XX
C
      GO TO 250
  230 C1VAL = 0.0
      C2VAL = 0.0
      GO TO 250
  240 C1VAL = 2.0*(VI1/D1+VI2/D2+VI3/D3)*XX-P1*VI1-P2*VI2-P3*VI3
      C2A = VO1 /D1 + VO2 /D2 + VO3 /D3
      C2B = P1 *VO1 + P2 *VO2 + P3 *VO3
      C2VAL = 2.0 *C2A *XX - C2B
      IF (INTRAC (I) .EQ. 0) GO TO 250
      C2C = VO1 *XX2 *XX3/D1 + VO2 *XX3 *XX1/D2 + VO3 *XX1 *XX2/D3
      FTEMP = C2A *XX **2 - C2B *XX + C2C
      IF (FTEMP .GT. 0.0) C2VAL = 5.0 *C2VAL /SQRT (FTEMP)
      IF (FTEMP .LE. 0.0) C2VAL = -100.
  250 IF (JJK .GT. 1) GO TO 260
      SLE1 (I) = C1VAL
      SLE2 (I) = C2VAL
      GO TO 270
  260 C1 (JK) = C1VAL
      C2 (JK) = C2VAL
  270 CONTINUE
      GO TO 300
C...
C...
C...FOR FLAT PLATE PANEL MAKE SLOPES EQUAL TO ZERO.
C...
C...
  280 DO 290 K = 1, MAX
      C1 (K) = 0.0
      C2 (K) = 0.0
  290 CONTINUE
      SLE1 (I) = 0.
      SLE2 (I) = 0.
C...
C...
C...STORE SLOPES OR LOAD COEFFICIENTS (AS CASE MAY BE) IN ARRAYS
C...DNDX1 AND DNDX2.
C...
C...
  300 DO 310 K = 1, MAX
      KED = KED + 1
      DNDX1 (KED) = C1 (K)
      DNDX2 (KED) = C2 (K)
  310 CONTINUE
C...
C...
```

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      C...IF VORTEX LATTICE IS TO BE LAID OUT ON BODY SURFACE RATHER          VORLAX   1872
      C...THAN ON SOME CYLINDRICAL CONTROL SURFACE (NON = 1), THEN THE        VORLAX   1873
      C...PROFILE OF THIS SURFACE AT THE PANEL EDGES IS COMPUTED IN THE       VORLAX   1874
      C...DO-LOOP ENDED BY LABEL 370. THE RESULTS ARE STORED IN THE ARRAY     VORLAX   1875
      C...GAMMA FOR USE IN SUBROUTINE GEOM. FOR FUSIFORM BODIES, BODY         VORLAX   1876
      C...SURFACE IMPLIES AUXILIARY BODY SURFACE.                             VORLAX   1877
      C...                                                                    VORLAX   1878
            NON = 1                                                           VORLAX   1879
            IF (NPP (I) .EQ. 0) NON = 0                                       VORLAX   1880
            IF (NAP .LT. 3) NON = 0                                           VORLAX   1881
            IF (ISYNT .EQ. 1) NON = 0                                         VORLAX   1882
            IF (NON .EQ. 0) GO TO 380                                         VORLAX   1883
      C...                                                                    VORLAX   1884
      C...                                                                    VORLAX   1885
            JC = 2                                                            VORLAX   1886
      C...                                                                    VORLAX   1887
            DO 370 JX = 1, MAX                                                VORLAX   1888
            KEGR = KEGR + 1                                                   VORLAX   1889
            RJX = JX                                                          VORLAX   1890
            IF (LAX .EQ. 1) GO TO 320                                         VORLAX   1891
            XX = (1.0 - COS ((RJX - 0.5) *PI /RNCV (I))) *50.0                VORLAX   1892
            GO TO 330                                                         VORLAX   1893
        320 XX = (RJX - 0.75) /RNCV (I) *100.0                                VORLAX   1894
        330 IF (XX .GE. XAF (JC - 1) .AND. XX .LE. XAF (JC))  GO TO 340       VORLAX   1895
            IF (JC .EQ. (NAP - 1)) GO TO 340                                  VORLAX   1896
            JC = JC + 1                                                       VORLAX   1897
            GO TO 330                                                         VORLAX   1898
        340 XX1 = XAF (JC - 1)                                                VORLAX   1899
            XX2 = XAF (JC)                                                    VORLAX   1900
            XX3 = XAF (JC + 1)                                                VORLAX   1901
            D1 = (XX1 - XX2) *(XX1 - XX3)                                     VORLAX   1902
            D2 = (XX2 - XX3) *(XX2 - XX1)                                     VORLAX   1903
            D3 = (XX3 - XX1) *(XX3 - XX2)                                     VORLAX   1904
            P1 = (XX2 + XX3) /D1                                              VORLAX   1905
            P2 = (XX3 + XX1) /D2                                              VORLAX   1906
            P3 = (XX1 + XX2) /D3                                              VORLAX   1907
            F1 = ZC1 (JC - 1)                                                 VORLAX   1908
            F2 = ZC1 (JC)                                                     VORLAX   1909
            F3 = ZC1 (JC + 1)                                                 VORLAX   1910
            FF1 = ZC2 (JC - 1)                                                VORLAX   1911
            FF2 = ZC2 (JC)                                                    VORLAX   1912
            FF3 = ZC2 (JC + 1)                                                VORLAX   1913
            C1A = F1 /D1 + F2 /D2 + F3 /D3                                    VORLAX   1914
            C1B = F1 *P1 + F2 *P2 + F3 *P3                                    VORLAX   1915
            C1C = F1 *XX2 *XX3 /D1 + F2 *XX3 *XX1 /D2 + F3 *XX1 *XX2 /D3      VORLAX   1916
            C2A = FF1 /D1 + FF2 /D2 + FF3 /D3                                 VORLAX   1917
            C2B = FF1 *P1 + FF2 *P2 + FF3 *P3                                 VORLAX   1918
            C2C = FF1 *XX2 *XX3 /D1 + FF2 *XX3 *XX1 /D2 + FF3 *XX1 *XX2 /D3   VORLAX   1919
            IF (ILE .EQ. 0 .OR. JC .GT. 2) GO TO 350                          VORLAX   1920
            B1A0 = SQRT (2.0 *RLE1)                                           VORLAX   1921
            B2A0 = SQRT (2.0 *RLE2)                                           VORLAX   1922
            B1C2 = F2 - B1A0 *SQRT (XX2) - F1                                 VORLAX   1923
            B2C2 = FF2 - B2A0 *SQRT (XX2) - FF1                               VORLAX   1924
            B1C3 = F3 - B1A0 *SQRT (XX3) - F1                                 VORLAX   1925
            B2C3 = FF3 - B2A0 *SQRT (XX3) - FF1                               VORLAX   1926
            B1A1 = (B1C2 *XX3 /XX2 - B1C3 *XX2 /XX3) /(XX3 - XX2)             VORLAX   1927
            B2A1 = (B2C2 *XX3 /XX2 - B2C3 *XX2 /XX3) /(XX3 - XX2)             VORLAX   1928
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              B1A2 = (B1C2 /XX2 - B1C3 /XX3) /(XX2 - XX3)                     VORLAX   1929
              B2A2 = (B2C2 /XX2 - B2C3 /XX3) /(XX2 - XX3)                     VORLAX   1930
              C1VAL = F1 + B1A0 *SQRT (XX) + B1A1 *XX + B1A2 *XX **2          VORLAX   1931
              C2VAL = FF1 + B2A0 *SQRT (XX) + B2A1 *XX + B2A2 *XX **2         VORLAX   1932
              GO TO 360                                                       VORLAX   1933
          350 C1VAL = C1A *XX **2 - C1B *XX + C1C                             VORLAX   1934
              C2VAL = C2A *XX **2 - C2B *XX + C2C                             VORLAX   1935
          360 KEGR2 = KEGR + MAX                                              VORLAX   1936
              GAMMA (KEGR) = C1VAL                                            VORLAX   1937
              GAMMA (KEGR2) = C2VAL                                           VORLAX   1938
          370 CONTINUE                                                        VORLAX   1939
        C...                                                                  VORLAX   1940
        C...                                                                  VORLAX   1941
        C...INDICES KEG AND KEGR DETERMINE LOCATION WITHIN GAMMA OF           VORLAX   1942
        C...CORRESPONDING PROFILE OR BODY GEOMETRY DATA.                      VORLAX   1943
        C...                                                                  VORLAX   1944
        C...ADJUST VALUES OF KEG AND KEGR.                                    VORLAX   1945
        C...                                                                  VORLAX   1946
          380 KEG = KEG + MAX                                                 VORLAX   1947
              KEGR = KEG                                                      VORLAX   1948
          390 CONTINUE                                                        VORLAX   1949
        C...                                                                  VORLAX   1950
        C...END OF PANEL GEOMETRY DEFINITION.                                 VORLAX   1951
        C...                                                                  VORLAX   1952
        C...                                                                  VORLAX   1953
        C...                                                                  VORLAX   1954
        C...READ IN FLOW FIELD SURVEY INFORMATION, IF ANY.                    VORLAX   1955
        C...                                                                  VORLAX   1956
              READ (5, 400) NXS, NYS, NZS                                     VORLAX   1957
              WRITE (6, 410) NXS, NYS, NZS                                    VORLAX   1958
          400 FORMAT (3 (I2, 8X))                                             VORLAX   1959
          410 FORMAT (1H0 , 3 (I2, 8X))                                       VORLAX   1960
              IF (NXS .GT. 0) READ (5, 50) (XS (I), I = 1, NXS)               VORLAX   1961
              IF (NXS .GT. 0) WRITE (6, 80) (XS (I), I = 1, NXS)              VORLAX   1962
              IF (NXS .GT. 0) READ (5, 50) YNOT, DELTAY, ZNOT, DELTAZ         VORLAX   1963
              IF (NXS .GT. 0) WRITE (6, 80) YNOT, DELTAY, ZNOT, DELTAZ        VORLAX   1964
              WRITE (6, 420)                                                  VORLAX   1965
          420 FORMAT (1H0, 39H********** END OF INPUT DECK ********** )       VORLAX   1966
        C                                                                     VORLAX   1967
        C                                                                     VORLAX   1968
              RETURN                                                          VORLAX   1969
              END                                                             VORLAX   1970


   SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    1   INPUT

VARIABLES       SN  TYPE            RELOCATION
 1440  AINC1        REAL        ARRAY    SET4          1464  AINC2      REAL        ARRAY    SET4
   20  ALFA         REAL                 SET11          334  ALOC       REAL        ARRAY    SET6
   10  ALPHA        REAL        ARRAY    SET11            1  BETA       REAL                 SET15
    0  BIG          REAL                 SET13         2142  B1A0       REAL
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VARIABLES      SN  TYPE             RELOCATION
  2150  B1A1       REAL                                2152  B1A2        REAL
  2144  B1C2       REAL                                2146  B1C3        REAL
     0  B2         REAL                   SET15        2143  B2A0        REAL
  2151  B2A1       REAL                                2153  B2A2        REAL
  2145  B2C2       REAL                                2147  B2C3        REAL
     2  CBAR       REAL                   SET15         240  CD          REAL      ARRAY    SET8
     0  CDC        REAL        ARRAY      SET9            1  CDTOT       REAL               SET12
     0  CHORD      REAL        ARRAY      SET10         170  CL          REAL      ARRAY    SET8
     0  CLTOT      REAL                   SET12         310  CM          REAL      ARRAY    SET8
   144  CMTC       REAL        ARRAY      SET17           2  CMTOT       REAL               SET12
   430  CN         REAL        ARRAY      SET8          144  CNC         REAL      ARRAY    SET9
     6  CNTOT      REAL                   SET12        2060  CORD1       REAL
  2067  CORD2      REAL                                 670  CRM         REAL      ARRAY    SET9
     5  CRTOT      REAL                   SET12         430  CSTART      REAL      ARRAY    SET5
     0  CSUC       REAL        ARRAY      SET17           0  CX          INTEGER   ARRAY    SET3
   550  CY         REAL        ARRAY      SET8         1010  CYM         REAL      ARRAY    SET8
     4  CYTOT      REAL                   SET12        2176  C1          REAL      ARRAY
  2172  C1A        REAL                                2173  C1B         REAL
  2174  C1C        REAL                                2154  C1VAL       REAL
  2260  C2         REAL        ARRAY                   2156  C2A         REAL
  2157  C2B        REAL                                2160  C2C         REAL
  2155  C2VAL      REAL                                   0  DCP         REAL      ARRAY    SET2
  2070  DELTAX     REAL                                   4  DELTAY      REAL               SET18
     6  DELTAZ     REAL                   SET18        2736  DESCR       REAL      ARRAY
   144  DL         REAL        ARRAY      SET10        2102  DMY         REAL
  2101  DMZ        REAL                                   0  DNDX1       REAL      ARRAY    SET4
   620  DNDX2      REAL        ARRAY      SET4           50  DRAG        REAL      ARRAY    SET8
  2050  DTR        REAL                                2124  D1          REAL
  2125  D2         REAL                                2126  D3          REAL
     3  EPS        REAL                   SET13        2167  FF1         REAL
  2170  FF2        REAL                                2171  FF3         REAL
    12  FLOATX     REAL                   / /            13  FLOATY      REAL               / /
   360  FN         REAL        ARRAY      SET8         2161  FTEMP       REAL
   500  FY         REAL        ARRAY      SET8         2164  F1          REAL
  2165  F2         REAL                                2166  F3          REAL
     0  GAMMA      REAL        ARRAY      SET16          11  HAG         REAL               / /
    24  HEAD       REAL        ARRAY      SET6         2051  I           INTEGER
  2072  IBOT       INTEGER                            13560  IDES        INTEGER   ARRAY    SET3
     3  IH         INTEGER                / /          2062  IL          INTEGER
  2111  ILE        INTEGER                             2063  IM          INTEGER
   404  INTRAC     INTEGER     ARRAY      SET20        2075  INV         INTEGER
    14  INVERS     INTEGER                / /          1110  IPAN        INTEGER   ARRAY    SET10
     2  IQ         INTEGER                / /           340  IQUANT      INTEGER   ARRAY    SET5
  2100  IR         INTEGER                               15  ISOLV       INTEGER            / /
  2061  ISTART     INTEGER                             2104  ISYNT       INTEGER
     1  ITER       INTEGER                SET13        2073  ITOP        INTEGER
     2  ITRMAX     INTEGER                SET13         170  ITS         INTEGER   ARRAY    SET7
  2074  J          INTEGER                             2114  JC          INTEGER
  2077  JJ         INTEGER                             2076  JJTOP       INTEGER
  2116  JJX        INTEGER                              214  JTS         INTEGER   ARRAY    SET7
  2117  JX         INTEGER                             2110  K           INTEGER
  2052  KED        INTEGER                             2053  KEG         INTEGER
  2054  KEGR       INTEGER                             2175  KEGR2       INTEGER
  2107  KEG2       INTEGER                                4  LATRAL      INTEGER            / /
     0  LAX        INTEGER                / /             1  LAY         INTEGER            / /
   240  LESWP      REAL        ARRAY      SET5            0  LIFT        REAL      ARRAY    SET8
  2106  L1         INTEGER                                0  MACH        REAL      ARRAY    SET11
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        SUBROUTINE INPUT      74/74    OPT=1                              FTN 4.5+410A       10/04/76  10.15.13        PAGE    12

VARIABLES      SN  TYPE            RELOCATION
  2105   MAX         INTEGER                                2115   MAXIM      INTEGER
   120   MOMENT      REAL         ARRAY     SET8              23   NALPHA     INTEGER                 SET11
  2103   NAP         INTEGER                                  22   NMACH      INTEGER                 SET11
  2162   NON         INTEGER                                   0   NPAN       INTEGER                 SET14
     3   NPANAS      INTEGER                SET14            360   NPP        INTEGER      ARRAY      SET20
     1   NT          INTEGER                SET14           2071   NV         INTEGER
   620   NVOR        REAL         ARRAY     SET5               0   NXS        INTEGER                 SET18
     1   NYS         INTEGER                SET18              2   NZS        INTEGER                 SET18
  3720   ONSET       REAL         ARRAY     SET16            170   PDL        REAL         ARRAY      SET5
  2425   PHI         REAL         ARRAY                       50   PHIMED     REAL         ARRAY      SET20
  2047   PI          REAL                                      6   PITCHQ     REAL                    / /
     5   PSI         REAL                   / /              550   PSPAN      REAL         ARRAY      SET5
  2127   P1          REAL                                   2130   P2         REAL
  2131   P3          REAL                                    214   RCS        REAL         ARRAY      SET20
  7640   RFLAG       REAL         ARRAY     SET3            2163   RJX        REAL
  2112   RLE1        REAL                                   2113   RLE2       REAL
     5   RLM         REAL                   SET13            620   RM         REAL         ARRAY      SET8
     0   RNCV        REAL         ARRAY     SET7              24   RNMAX      REAL         ARRAY      SET7
  2342   RO          REAL         ARRAY                        7   ROLLQ      REAL                    / /
  2140   SIGN1       REAL                                   2141   SIGN2      REAL
    50   SLE         REAL         ARRAY     SET19              0   SLE1       REAL         ARRAY      SET19
    24   SLE2        REAL         ARRAY     SET19           3720   SLOPE      REAL         ARRAY      SET2
     2   SMAX        REAL                   SET14            310   SPC        REAL         ARRAY      SET17
     3   SREF        REAL                   SET12           1130   SURF       REAL         ARRAY      SET8
  3720   SX          INTEGER      ARRAY     SET3             310   SYNTH      REAL         ARRAY      SET5
   500   TAPER       REAL         ARRAY     SET5               0   TITLE      INTEGER      ARRAY      SET6
   454   TNL         REAL         ARRAY     SET10            620   TNT        REAL         ARRAY      SET10
    21   VINF        REAL                   SET11           2132   VI1        REAL
  2133   VI2         REAL                                   2134   VI3        REAL
  2135   VO1         REAL                                   2136   VO2        REAL
  2137   VO3         REAL                                   7640   VSP        REAL         ARRAY      SET2
   310   VSS         REAL         ARRAY     SET10          10270   VST        REAL         ARRAY      SET20
     4   WSPAN       REAL                   SET13              0   X          REAL         ARRAY      SET1
  2510   XAF         REAL         ARRAY                        0   XAPEX      REAL         ARRAY      SET5
     3   XBAR        REAL                   SET15              7   XS         REAL         ARRAY      SET18
  1060   XSUC        REAL         ARRAY     SET8             764   XTE        REAL         ARRAY      SET10
  2120   XX          REAL                                   2121   XX1        REAL
  2122   XX2         REAL                                   2123   XX3        REAL
  2055   X1          REAL                                   2064   X2         REAL
  3720   Y           REAL         ARRAY     SET1              50   YAPEX      REAL         ARRAY      SET5
    10   YAWQ        REAL                   / /              740   YM         REAL         ARRAY      SET8
     3   YNOT        REAL                   SET18            430   YY         REAL         ARRAY      SET20
  2056   Y1          REAL                                   2065   Y2         REAL
  4064   Z           REAL         ARRAY     SET1             120   ZAPEX      REAL         ARRAY      SET5
     4   ZBAR        REAL                   SET15           4230   ZC         REAL         ARRAY      SET1
  2572   ZC1         REAL         ARRAY                     2654   ZC2        REAL         ARRAY
   214   ZETA        REAL         ARRAY     SET19              0   ZLE1       REAL         ARRAY      SET20
    24   ZLE2        REAL         ARRAY     SET20              5   ZNOT       REAL                    SET18
  4350   ZZ          REAL         ARRAY     SET20           2057   Z1         REAL
  2066   Z2          REAL

FILE NAMES         MODE
        TAPE5      FMT                      TAPE6      FMT

EXTERNALS             TYPE    ARGS
        ATAN2      REAL        2 LIBRARY                     COS        REAL         1 LIBRARY
        SIN        REAL        1 LIBRARY                     SQRT       REAL         1 LIBRARY
```

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       SUBROUTINE INPUT       74/74    OPT=1                                FTN 4.5+410         10/04/76  10.15.13        PAGE    13

INLINE FUNCTIONS    TYPE    ARGS
       FLOAT      REAL       1  INTRIN

STATEMENT LABELS
  1364  10       FMT                         1367  20       FMT                        1443  30       FMT
  1446  40       FMT                         1463  50       FMT                        1465  60       FMT
  1474  70       FMT                         1501  80       FMT                           0  90
  1567  100      FMT                         1572  110      FMT                           0  120
   212  130                                     0  140                                  345  150
  1641  160      FMT                         1644  170      FMT                           0  180
   456  190                                   556  200                                  564  210
   573  220                                   724  230                                  726  240
  1000  250                                  1006  260                                 1011  270
  1014  280                                     0  290                                 1025  300
     0  310                                  1066  320                                 1072  330
  1101  340                                  1264  350                                 1274  360
     0  370                                  1303  380                                    0  390
  1763  400      FMT                         1765  410      FMT                        2023  420      FMT

LOOPS  LABEL     INDEX     FROM-TO    LENGTH     PROPERTIES
   66  390     • I          156 534    1222B              EXT REFS  NOT INNER
  101  90        IL         172 175      4B       INSTACK
  205  120       J          231 234      4B       INSTACK
  223          • JJ         244 244     10B               EXT REFS
  237          • JJ         245 245     10B               EXT REFS
  253  140     • IR         253 266     65B               EXT REFS
  420  180       L1         299 304      4B       INSTACK
  544  270     • JJX        366 431    250B               EXT REFS
 1017  290       K          438 441      3B       INSTACK
 1031  310       K          450 454      4B       INSTACK
 1053  370     • JX         473 524    230B               EXT REFS

COMMON BLOCKS   LENGTH
       / /          14
       SET1       2220
       SET2       6000
       SET3       8000
       SET4        840
       SET5        440
       SET6       2220
       SET7        240
       SET8        640
       SET9        200
       SET10       700
       SET11        20
       SET12         7
       SET13         6
       SET14         4
       SET15         5
       SET16      4000
       SET17       240
       SET18        27
       SET19       240
       SET20      6280

STATISTICS
  PROGRAM LENGTH                  2750B      1512
  CM LABELED COMMON LENGTH       77111B     32329
```

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STATISTICS
  CM BLANK COMMON LENGTH          16B        14
```

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CONTROL*VRLX.MAP                                               9/14/76  VORLAX    1971
C...                                                                    VORLAX    1972
      SUBROUTINE MAP (EW, EWX, EWY, ITOTAL)                             VORLAX    1973
C...                                                                    VORLAX    1974
C...PURPOSE    TO COMPUTE THE FLOW FIELD ABOUT THE CONFIGURATION.       VORLAX    1975
C...                                                                    VORLAX    1976
C...INPUT      CALLING SEQUENCES                                        VORLAX    1977
C...           EW = UPWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED      VORLAX    1978
C...                ROW BY ROW FROM UNIT 3).                            VORLAX    1979
C...           EWX = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED  VORLAX    1980
C...                 ROW BY ROW FROM UNIT 4).                           VORLAX    1981
C...           EWY = SIDEWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED   VORLAX    1982
C...                 ROW BY ROW FROM UNIT 7).                           VORLAX    1983
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.             VORLAX    1984
C...           COMMONS                                                  VORLAX    1985
C...           IH, IQ, NT, XS, NXS, NYS, NZS, PSI, ALFA, MACH, YNOT,    VORLAX    1986
C...           ZNOT, ALPHA, GAMMA, RNMAX, DELTAY, DELTAZ.               VORLAX    1987
C...                                                                    VORLAX    1988
C...OUTPUT     CALLING SEQUENCES                                        VORLAX    1989
C...           NONE.                                                    VORLAX    1990
C...           COMMONS                                                  VORLAX    1991
C...           NONE.                                                    VORLAX    1992
C...           DIRECT PRINTS                                            VORLAX    1993
C...           XS, YKI, ZKI = FIELD GRID POINT COORDINATES (BODY AXIS   VORLAX    1994
C...                          SYSTEM).                                  VORLAX    1995
C...           VX, VF, WF = TOTAL DIMENSIONLESS (REFERENCED TO VELO     VORLAX    1996
C...                        CITY AT UPSTREAM INFINITY) VELOCITY COMPO-  VORLAX    1997
C...                        NENTS ALONG THE X-Y-Z AXES RESPECTIVELY     VORLAX    1998
C...                        (BODY AXIS SYSTEM).                         VORLAX    1999
C...           EPSLON = UPWASH FLOW ANGLE IN DEGREES.                   VORLAX    2000
C...           SIGMA = SIDEWASH FLOW ANGLE IN DEGREES.                  VORLAX    2001
C...           CP = LOCAL PRESSURE COEFFICIENT.                         VORLAX    2002
C...           RM = LOCAL MACH NUMBER.                                  VORLAX    2003
C...           PPTOT = (LOCAL STATIC PRESSURE)/(TOTAL PRESSURE).        VORLAX    2004
C...           PIF = (LOCAL STATIC PRESSURE)/(FREE STREAM STATIC PRES   VORLAX    2005
C...                 SURE).                                             VORLAX    2006
C...                                                                    VORLAX    2007
C...SUBROUTINES                                                         VORLAX    2008
C...CALLED     NONE.                                                    VORLAX    2009
C...                                                                    VORLAX    2010
C...DISCUSSION FLOW FIELD QUANTITIES ARE COMPUTED AT THE NODAL POINTS   VORLAX    2011
C...           OF A 3-D GRID DEFINED AROUND THE CONFIGURATION BY A SET  VORLAX    2012
C...           OF ORTHOGONAL PLANES ( X = CONST., Y = CONST., AND       VORLAX    2013
C...           Z = CONST. PLANES). THE VELOCITIES ARE CALCULATED BY     VORLAX    2014
C...           THE USE OF INFLUENCE COEFFICIENT MATRICES BASED ON THE   VORLAX    2015
C...           VORTEX LATTICE REPRESENTATION OF THE CONFIGURATION.      VORLAX    2016
C...           THESE MATRICES ARE COMPUTED IN SUBROUTINE SURVEY AND     VORLAX    2017
C...           STORED IN UNITS 3, 4, AND 7 (ONE MATRIX AND ONE UNIT     VORLAX    2018
C...           PER VELOCITY COMPONET). THE PRESSURE RATIOS AND RELATED  VORLAX    2019
C...           FLOW QUANTITIES ARE COMPUTED THROUGH THE USE OF ISEN     VORLAX    2020
C...           TROPIC FLOW RELATIONSHIPS.                               VORLAX    2021
C                                                                       VORLAX    2022
C                                                                       VORLAX    2023
C...                                                                    VORLAX    2024
      DIMENSION EW (ITOTAL), EWX (ITOTAL), EWY (ITOTAL)                 VORLAX    2025
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,   VORLAX    2026
     * FLOATX                                                           VORLAX    2027
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      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                 VORLAX    2028
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)         VORLAX    2029
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA     VORLAX    2030
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                            VORLAX    2031
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                    VORLAX    2032
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20) VORLAX    2033
      INTEGER TITLE                                                     VORLAX    2034
      REAL MACH                                                         VORLAX    2035
C                                                                       VORLAX    2036
      PI = 3.14159                                                      VORLAX    2037
      DTR = 0.01745329                                                  VORLAX    2038
C                                                                       VORLAX    2039
C                                                                       VORLAX    2040
      REWIND 3                                                          VORLAX    2041
      REWIND 4                                                          VORLAX    2042
      REWIND 7                                                          VORLAX    2043
      COSA = COS (ALFA)                                                 VORLAX    2044
      SINA = SIN (ALFA)                                                 VORLAX    2045
      COPSI = COS (DTR * PSI)                                           VORLAX    2046
      SIPSI = SIN (DTR * PSI)                                           VORLAX    2047
C                                                                       VORLAX    2048
C...LINE IS AN OUTPUT LINE COUNTER USED TO DETERMINE WHEN TO SWITCH     VORLAX    2049
C...TO A NEW PRINTOUT PAGE.                                             VORLAX    2050
C                                                                       VORLAX    2051
      LINE = 1                                                          VORLAX    2052
      DO 80 I = 1, NXS                                                  VORLAX    2053
      DO 70 J1 = 1, NZS                                                 VORLAX    2054
      RJ1 = J1                                                          VORLAX    2055
C                                                                       VORLAX    2056
C...COMPUTE COORDINATES IN CROSS-FLOW PLANE, ZK1 AND YK1.               VORLAX    2057
C                                                                       VORLAX    2058
      ZK1 = ZNOT + DELTAZ * (RJ1 - 1.)                                  VORLAX    2059
      DO 70 K1 = 1, NYS                                                 VORLAX    2060
      RK1 = K1                                                          VORLAX    2061
      YK1 = YNOT + DELTAY * (RK1 - 1.)                                  VORLAX    2062
C                                                                       VORLAX    2063
C...READ IN INDUCED VELOCITY COMPONENT INFLUENCE COEFFICIENTS.          VORLAX    2064
C                                                                       VORLAX    2065
      READ (3) EW                                                       VORLAX    2066
      READ (4) EWX                                                      VORLAX    2067
      READ (7) EWY                                                      VORLAX    2068
C                                                                       VORLAX    2069
C...COMPUTE INDUCED VELOCITY COMPONENTS.                                VORLAX    2070
C                                                                       VORLAX    2071
      IR = 0                                                            VORLAX    2072
      UF = 0.                                                           VORLAX    2073
      VF = 0.                                                           VORLAX    2074
      WF = 0.                                                           VORLAX    2075
      DO 10 K = 1, NT                                                   VORLAX    2076
      MAX = RNMAX (K)                                                   VORLAX    2077
      DO 10 J = 1, MAX                                                  VORLAX    2078
      IR = IR + 1                                                       VORLAX    2079
      UF = UF + GAMMA (IR) *EWX (IR)                                    VORLAX    2080
      VF = VF + GAMMA (IR) *EWY (IR)                                    VORLAX    2081
      WF = WF + GAMMA (IR) *EW (IR)                                     VORLAX    2082
   10 CONTINUE                                                          VORLAX    2083
      VX = COSA *COPSI + UF                                             VORLAX    2084
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            VF = COSA *SIPSI + VF                                           VORLAX  2085
            WF = SINA + WF                                                  VORLAX  2086
      C                                                                     VORLAX  2087
      C...IF AN INCOMPRESSIBLE CASE IS BEING CONSIDERED (MACH = 0.) THEN    VORLAX  2088
      C...THE FLOW IS MADE SLIGHTLY COMPRESSIBLE (MACH = 0.01) TO ALLOW THE VORLAX  2089
      C...USE OF COMPRESSIBLE ISENTROPIC FLOW FORMULAS.                     VORLAX  2090
      C                                                                     VORLAX  2091
            XM = 0.01                                                       VORLAX  2092
            IF (MACH (IQ) .GT. XM) XM = MACH (IQ)                           VORLAX  2093
            XM2 = XM **2                                                    VORLAX  2094
            A2 = (1. + .2 *XM2) /(1.2 *XM2)                                 VORLAX  2095
            VR2 = VX **2 + VF **2 + WF **2                                  VORLAX  2096
            VRATIO = VR2 /A2                                                VORLAX  2097
            VCAL = VRATIO                                                   VORLAX  2098
            IF (VRATIO .GT. 5.5) VRATIO = 5.5                               VORLAX  2099
      C                                                                     VORLAX  2100
      C...THE VELOCITIES INDUCED BY THE VORTEX LATTICE MAY BE TOO HIGH DUE  VORLAX  2101
      C...TO THE NUMERICAL SINGULARITIES INHERENT TO A LATTICE GEOMETRY. CAL VORLAX  2102
      C...IS A CORRECTION APPLIED TO PREVENT LESS-THAN-VACUUM PRESSURES     VORLAX  2103
      C...DUE TO SUCH SINGULARITIES.                                        VORLAX  2104
      C                                                                     VORLAX  2105
            CAL = 1.0                                                       VORLAX  2106
            IF (VCAL .GT. 0.0) CAL = SQRT (VRATIO /VCAL)                    VORLAX  2107
            VX = VX *CAL                                                    VORLAX  2108
            VF = VF *CAL                                                    VORLAX  2109
            WF = WF *CAL                                                    VORLAX  2110
            VR2 = VR2 *CAL *CAL                                             VORLAX  2111
            EPSLON = 1. /DTR *ATAN2 (WF, VX)                                VORLAX  2112
            SIGMA = 1. /DTR *ATAN2 (VF, VX)                                 VORLAX  2113
            RM2 = 2. *VRATIO /(2.4 - .4 *VRATIO)                            VORLAX  2114
            PPTOT = (1.0 - .4 *VRATIO /2.4 ) **3.5                          VORLAX  2115
            PIPT = (1.0 - 0.4 /(2.4 *A2)) **3.5                             VORLAX  2116
            PIF = PPTOT /PIPT                                               VORLAX  2117
            CP = ((1.0 + 0.2 *XM2 * (1. - VR2)) **3.5 - 1.) /(.7 * XM2)     VORLAX  2118
            IF (XM .LE. 0.1) CP = 1. - VR2                                  VORLAX  2119
            RM = SQRT (RM2)                                                 VORLAX  2120
            IF (LINE .EQ. 1) WRITE (6, 20) TITLE                            VORLAX  2121
       20   FORMAT (1H1 , 20A4)                                             VORLAX  2122
            IF (LINE .EQ. 1) WRITE (6, 30) MACH (IQ), ALPHA (IM)            VORLAX  2123
       30   FORMAT (1H0, 6HMACH =, F7.3, 6X,7HALPHA =, F7.3,5H DEG.)        VORLAX  2124
            IF (LINE .EQ. 1) LINE = 3                                       VORLAX  2125
            IF (LINE .EQ. 3) WRITE (6, 40)                                  VORLAX  2126
       40   FORMAT (1H0,40H     X          Y          Z          U          VORLAX  2127
           + 40H     V          W         EPSILON    SIGMA   ,              VORLAX  2128
           + 40H     CP        MLOC       P/PTOT     P/PINF)                VORLAX  2129
            IF (LINE .EQ. 3) WRITE (6, 50)                                  VORLAX  2130
       50   FORMAT (1H0 )                                                   VORLAX  2131
            IF (LINE .EQ. 3) LINE = 7                                       VORLAX  2132
            WRITE (6, 60 ) XS (I), YK1, ZK1, VX, VF, WF, EPSLON, SIGMA, CP, VORLAX  2133
           + RN, PPTOT, PIF                                                 VORLAX  2134
         60 FORMAT (1H1 , 6F10.4, F8.2, F10.2, F12.4, 3F10.4)               VORLAX  2135
            LINE = LINE + 1                                                 VORLAX  2136
            IF (LINE .GT. 45) LINE = 1                                      VORLAX  2137
       70   CONTINUE                                                        VORLAX  2138
            WRITE (6, 50)                                                   VORLAX  2139
            IF (LINE .NE. 1) LINE = LINE + 2                                VORLAX  2140
       80   CONTINUE                                                        VORLAX  2141
       SUBROUTINE MAP         74/74    OPT=1                                FTN 4.5+410A        10/04/76  10.15.13          PAGE      4

                                 REWIND 3                                                               VORLAX      2142
                                 REWIND 4                                                               VORLAX      2143
                                 REWIND 7                                                               VORLAX      2144
   175                           RETURN                                                                 VORLAX      2145
                                 END                                                                    VORLAX      2146


       SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  MAP

VARIABLES      SN  TYPE              RELOCATION
    20  ALFA      REAL                    SET11           334  ALOC      REAL          ARRAY     SET6
    10  ALPHA     REAL         ARRAY      SET11           502  A2        REAL
   506  CAL       REAL                                    456  COPSI     REAL
   454  COSA      REAL                                    515  CP        REAL
     4  DELTAY    REAL                    SET19             6  DELTAZ    REAL                    SET18
   453  DTR       REAL                                    517  EPSLON    REAL
     0  EW        REAL         ARRAY       F.P.             0  FMX       REAL          ARRAY      F.P.
     0  EWY       REAL         ARRAY       F.P.            12  FLOATX    REAL                    / /
     0  GAMMA     REAL         ARRAY      SET16            11  MAG       REAL                    / /
    24  HEAD      REAL         ARRAY      SET6            461  I         INTEGER
     3  IH        INTEGER                 / /               2  IQ        INTEGER                 / /
   470  IR        INTEGER                                   0  ITOTAL    INTEGER                  F.P.
   170  ITS       INTEGER      ARRAY      SET7            476  J         INTEGER
   214  JTS       INTEGER      ARRAY      SET7            462  J1        INTEGER
   474  K         INTEGER                                 465  K1        INTEGER
     4  LATRAL    INTEGER                 / /               0  LAX       INTEGER                 / /
     1  LAY       INTEGER                 / /             460  LINE      INTEGER
     0  MACH      REAL         ARRAY      SET11           475  MAX       INTEGER
    23  NALPHA    INTEGER                 SET11            22  NMACH     INTEGER                 SET11
     0  NPAN      INTEGER                 SET14             3  NPANAS    INTEGER                 SET14
     1  NT        INTEGER                 SET14             0  NXS       INTEGER                 SET18
     1  NYS       INTEGER                 SET18             2  NZS       INTEGER                 SET18
  3720  ONSET     REAL         ARRAY      SET16           452  PI        REAL
   514  PIF       REAL                                    513  PIPI      REAL
     6  PITCHQ    REAL                    / /             512  PPTOT     REAL
     5  PSI       REAL                    / /             463  RJ1       REAL
   466  RK1       REAL                                    516  RM        REAL
   511  RM2       REAL                                      0  RNCV      REAL          ARRAY     SET7
    24  RNMAX     REAL         ARRAY      SET7              7  ROLLQ     REAL                    / /
   510  SIGMA     REAL                                    455  SINA      REAL
   457  SIPSI     REAL                                      2  SMAX      REAL                    SET14
     0  TITLE     INTEGER      ARRAY      SET6            471  UF        REAL
   505  VCAL      REAL                                    472  VF        REAL
    21  VINF      REAL                    SET11           504  VRATIO    REAL
   503  VR2       REAL                                    477  VX        REAL
   473  WF        REAL                                    500  XM        REAL
   501  XM2       REAL                                      7  XS        REAL          ARRAY     SET18
    10  YAWQ      REAL                    / /             467  YK1       REAL
     3  YNOT      REAL                    SET18           464  ZK1       REAL
     5  ZNOT      REAL                    SET18
```

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        SUBROUTINE MAP        74/74    OPT=1                            FTN 4.5+410A        10/04/76  10.15.13        PAGE

FILE NAMES         MODE
        TAPE3     UNFMT               TAPE4      UNFMT               TAPE5     FMT                 TAPE7      UNFMT

EXTERNALS           TYPE    ARGS
        ATAN2     REAL        2 LIBRARY                   COS       REAL        1 LIBRARY
        SIN       REAL        1 LIBRARY                   SQRT      REAL        1 LIBRARY

STATEMENT LABELS
     0  10                              336  20      FMT                        345  30      FMT
   356  40      FMT                     400  50      FMT                        421  60      FMT
     0  70                                0  80

LOOPS   LABEL    INDEX     FROM-TO    LENGTH     PROPERTIES
        80     * I         83 171      245B              EXT REFS  NOT INNER
    41  70     * J1        84 160      234B              EXT REFS  NOT INNER
    47  70     * K1        90 160      224B              EXT REFS  NOT INNER
    77  10     * K        106 113       23B              NOT INNER
   107  10       J        108 113        7B      INSTACK

COMMON BLOCKS    LENGTH
        / /          11
        SET6       2220
        SET7        240
        SET11        20
        SET14         4
        SET16      4000
        SET18        27

STATISTICS
  PROGRAM LENGTH                     534B       348
  CM LABELED COMMON LENGTH         14557B      6511
  CM BLANK COMMON LENGTH              13B        11
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      CONTROL*VRLX.MATRX                                       9/16/76  VORLAX    2147
      C...                                                              VORLAX    2148
            SUBROUTINE MATRX (EW, EU, ITOTAL)                           VORLAX    2149
      C....                                                             VORLAX    2150
      C...PURPOSE    TO GENERATE THREE AERODYNAMIC INFLUENCE COEFF. MATRI VORLAX    2151
      C...           CES (1) THE NORMALWASH AT THE CONTROL POINTS       VORLAX    2152
      C...           (EW / UNIT 1), (2) THE AXIALWASH AT THE CONTROL POINTS VORLAX  2153
      C...           (EU / UNIT 2), AND (3) THE NORMALWASH AT THE LEAD. EDGE VORLAX 2154
      C...           (EW / UNIT 9). THESE MATRICES REPRESENT THE INDUCED VORLAX   2155
      C...           VELOCITY FIELD DUE TO THE HORSESHOE VORTICES OF THE VORLAX   2156
      C...           LATTICE.                                           VORLAX    2157
      C...                                                              VORLAX    2158
      C...INPUT      CALLING SEQUENCES                                  VORLAX    2159
      C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.       VORLAX    2160
      C...           COMMONS                                            VORLAX    2161
      C...           X, B2, CX, DL, NT, SX, YY, ZZ, MAG, LAX, NPP, PSI, TNT, VORLAX 2162
      C...           VSP, VST, XTE, ALFA, IPAN, XBAR, ZBAR, CHORD, RFLAG, VORLAX  2163
      C...           SMAX, SLOPE, FLOATX, FLOATY, INVERS, LATRAL.       VORLAX    2164
      C...                                                              VORLAX    2165
      C...OUTPUT     CALLING SEQUENCES                                  VORLAX    2166
      C...           EW = CONTROL POINT NORMALWASH MATRIX (STORED ROW BY VORLAX   2167
      C...                ROW IN UNIT 1).                               VORLAX    2168
      C...           EW = LEADING EDGE NORMALWASH MATRIX (STORED ROW BY VORLAX    2169
      C...                ROW IN UNIT 9).                               VORLAX    2170
      C...           EU = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 2). VORLAX  2171
      C...           COMMONS                                            VORLAX    2172
      C...           NONE.                                              VORLAX    2173
      C...                                                              VORLAX    2174
      C...SUBROUTINES                                                   VORLAX    2175
      C...CALLED     WASH, UXVEL.                                       VORLAX    2176
      C...                                                              VORLAX    2177
      C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES VORLAX    2178
      C...           ARE GENERATED BY COMPUTING THE CORRESPONDING VELOCITY VORLAX 2179
      C...           INDUCED AT THE (KI,JI) CONTROL POINT BY THE (K,J)  VORLAX    2180
      C...           HORSESHOE VORTEX OF UNIT STRENGTH. IF K = KI AND   VORLAX    2181
      C...           J = JI (SELF-INFLUENCE) THEN THE PRINCIPAL PART OF VORLAX    2182
      C...           THE DOWNWASH INTEGRAL IS ADDED TO THE COMPUTATION OF VORLAX  2183
      C...           THE CORRESPONDING EW COEFFICIENT. ALSO IF THE CONTROL VORLAX 2184
      C...           POINT IS WITHIN A GIVEN NEAR FIELD RADIUS OF THE   VORLAX    2185
      C...           INDUCING HORSESHOE VORTEX, THE AXIALWASH CONTRIBUTION VORLAX 2186
      C...           IS COMPUTED BY INTERDIGITATED VORTEX SPLITTING.    VORLAX    2187
      C...                                                              VORLAX    2188
      C...                                                              VORLAX    2189
            DIMENSION EW (ITOTAL), EU (ITOTAL)                          VORLAX    2190
            COMMON LAX, LAY, IQ, IM, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG, VORLAX 2191
           * FLOATX, FLOATY, INVERS, ISOLV                              VORLAX    2192
            COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)           VORLAX    2193
            COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)          VORLAX    2194
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            COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                   VORLAX    2201
            COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100), VORLAX  2202
           * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)      VORLAX    2203
      INTEGER CX, SX , FLAG                                             VORLAX   2204
C                                                                       VORLAX   2205
      PI = 3.14159                                                      VORLAX   2206
      DTR = 0.01745329                                                  VORLAX   2207
C                                                                       VORLAX   2208
C                                                                       VORLAX   2209
      REWIND 1                                                          VORLAX   2210
      REWIND 2                                                          VORLAX   2211
      REWIND 9                                                          VORLAX   2212
      FLAX = LAX                                                        VORLAX   2213
      FAL = FLOATX *ALFA                                                VORLAX   2214
      FBL = FLOATY *PSI * DTR                                           VORLAX   2215
      MM = 0                                                            VORLAX   2216
      IF (FAL .NE. 0.0 .OR. FBL .NE. 0.0) MM = 1                        VORLAX   2217
      SI2A = SIN  (2.0 *ALFA)                                           VORLAX   2218
      CO2A = COS (2.0 *ALFA)                                            VORLAX   2219
      HIM = HAG - ZBAR *COS (ALFA) + XBAR *SIN (ALFA)                   VORLAX   2220
      XIMO = 2.0 *HIM *SIN (ALFA)                                       VORLAX   2221
      ZIMO = - 2.0 *HIM *COS (ALFA)                                     VORLAX   2222
      TAN2A = SI2A /CO2A                                                VORLAX   2223
C                                                                       VORLAX   2224
C                                                                       VORLAX   2225
C...THERE ARE TWO MAJOR DOUBLE DO-LOOPS THAT GENERATE THE COEFFICIENTS  VORLAX   2226
C...OF THE AERODYNAMIC INFLUENCE MATRICES : (1) THOSE ENDED BY LABEL    VORLAX   2227
C...230 AND (2) THOSE ENDED BY LABEL 210. THE FIRST (OUTER) 230-LOOP    VORLAX   2228
C...DETERMINES THE VORTEX STRIP, AND THE SECOND (INNER) 230-LOOP        VORLAX   2229
C...LOCATES THE POINT WITHIN THAT STRIP AT WHICH THE INDUCED            VORLAX   2230
C...VELOCITIES WILL BE COMPUTED. THE FIRST (OUTER) 210-LOOP             VORLAX   2231
C...ESTABLISHES THE STRIP, AND THE SECOND (INNER) 210-LOOP DETERMINES   VORLAX   2232
C...THE HORSESHOE VORTEX WITHIN THAT STRIP WHOSE INFLUENCE IS TO BE     VORLAX   2233
C...COMPUTED. THE 210-LOOPS ARE NESTED WITHIN THE 230-LOOPS.            VORLAX   2234
C                                                                       VORLAX   2235
C                                                                       VORLAX   2236
      IHR = 1                                                           VORLAX   2237
C                                                                       VORLAX   2238
C                                                                       VORLAX   2239
C                                                                       VORLAX   2240
      DO 230 K1 = 1, NT                                                 VORLAX   2241
      KEY = IPAN(K1)                                                    VORLAX   2242
      MAX = RNMAX (K1)                                                  VORLAX   2243
      COX = 1.0 - FLAX + FLAX *CHORD (K1) /RNMAX (K1)                   VORLAX   2244
      PION = PI /RNMAX (K1)                                             VORLAX   2245
      MAXIM = MAX + 1                                                   VORLAX   2246
C                                                                       VORLAX   2247
      DO 230 JJ1 = 1, MAXIM                                             VORLAX   2248
C                                                                       VORLAX   2249
C...JJ1 = 1 CORRESPONDS TO THE VERY LEADING EDGE. IT IS NOT A CONTROL   VORLAX   2250
C...POINT IN THE CONVENTIONAL SENSE, BUT THE NORMALWASH INFLUENCE       VORLAX   2251
C...COEFFICIENT IS NEEDED FOR THE COMPUTATION OF THE LEADING EDGE       VORLAX   2252
C...SUCTION IN ACCORDANCE WITH LAN'S PROCEDURE.                         VORLAX   2253
C                                                                       VORLAX   2254
      J1 = JJ1 - 1                                                      VORLAX   2255
      RJ1 = J1                                                          VORLAX   2256
C                                                                       VORLAX   2257
C...LOCATE SENSING, OR RECEIVING, POINT ON CORRESPONDING CONTROL        VORLAX   2258
C...SURFACE, EITHER ON ACTUAL BODY SURFACE (NPP = 1) OR ON CYLINDRICAL  VORLAX   2259
C...SURFACE IN THE PROXIMITY OF BODY (NPP = 0).                         VORLAX   2260
```

```
      C                                                                   VORLAX  2261
            DELTAX = .5 *(COS ((KJ1 - .5) *PION) - COS (KJ1*PION))          VORLAX  2262
            IF (J1 .EQ. 0) J1 = 1                                           VORLAX  2263
            IF (LAX .EQ. 1) DELTAX = .5 /RNMAX (K))                         VORLAX  2264
            XCNTL = X (IRR) + DELTAX *CHORD (K))                            VORLAX  2265
      C                                                                   VORLAX  2266
            IRRB = IRR                                                      VORLAX  2267
            IF (CX(IRR) .LT. MAX) IRRB = IRR + 1                            VORLAX  2268
            IRRA = IRRB - 1                                                 VORLAX  2269
            RATIO = (XCNTL - X (IRRA)) /( X (IRRB) - X (IRRA))              VORLAX  2270
            YCNTL = YY (IRRA) *(1.0 - RATIO) + YY (IRRB) *RATIO             VORLAX  2271
            ZCNTL = ZZ (IRRA) *(1.0 - RATIO) + ZZ (IRRB) *RATIO             VORLAX  2272
      C                                                                   VORLAX  2273
      C...IF NPP = 1 THEN THE SURFACE NORMAL DIRECTION COSINES ARE COMPUTED VORLAX  2274
      C...EXACTLY, OTHERWISE THE USUAL TRIGONOMETRIC APPROXIMATIONS ARE     VORLAX  2275
      C...APPLIED, E.G., SINE = TANGENT = ARGUMENT.                         VORLAX  2276
      C                                                                   VORLAX  2277
            COSINE = 1.0                                                    VORLAX  2278
            SINE = 0.0                                                      VORLAX  2279
            IF (NPP (KEY)  .EQ. 0)  GO TO 10                                VORLAX  2280
            SINE = SLOPE (IRR) /SQRT (1.0 + SLOPE (IRR) **2)                VORLAX  2281
            COSINE = SQRT (1.0 - SINE **2)                                  VORLAX  2282
       10   CONTINUE                                                        VORLAX  2283
      C                                                                   VORLAX  2284
            IF (JJ1 .EQ. 1) GO TO 30                                        VORLAX  2285
      C                                                                   VORLAX  2286
      C...DETERMINE IF TRANSVERSE VORTEX LEG OF HORSESHOE ASSOCIATED TO THE VORLAX  2287
      C...CONTROL POINT UNDER CONSIDERATION IS SONIC (SWEPT PARALLEL TO MACH VORLAX  2288
      C...LINE), IF SO THEN RFLAG = 0.0, OTHERWISE RFLAG = 1.0.             VORLAX  2289
      C                                                                   VORLAX  2290
            FLAG = 0                                                        VORLAX  2291
            ESPI = VSP (IRR)                                                VORLAX  2292
            T2 = ESPI *ESPI                                                 VORLAX  2293
            IF (B2 .LE. 0.0) GO TO 20                                       VORLAX  2294
            IF (J1 .EQ. 1) GO TO 20                                         VORLAX  2295
            IF (J1 .EQ. MAX) GO TO 20                                       VORLAX  2296
            ESPF = VSP (IRR - 1)                                            VORLAX  2297
            T2F = ESPF *ESPF                                                VORLAX  2298
            ESPA = VSP (IRR + 1)                                            VORLAX  2299
            T2A = ESPA *ESPA                                                VORLAX  2300
            TRANS = (B2 - T2F) * (B2 - T2A)                                 VORLAX  2301
            IF (TRANS .LT. 0.0) FLAG = 1                                    VORLAX  2302
       20   RFLAG (IRR) = 1 - FLAG                                          VORLAX  2303
      C                                                                   VORLAX  2304
      C...COMPUTE THE GENERALIZED PRINCIPAL PART OF THE VORTEX-INDUCED      VORLAX  2305
      C...VELOCITY INTEGRAL, WWAVE.                                         VORLAX  2306
      C                                                                   VORLAX  2307
            WWAVE = 0.0                                                     VORLAX  2308
            IF (B2 .GT. T2) WWAVE = - 0.5 *SQRT (B2 - T2) /COX              VORLAX  2309
       30   IR = 0                                                          VORLAX  2310
      C                                                                   VORLAX  2311
      C                                                                   VORLAX  2312
      C...COMPUTE HORSESHOE VORTEX INDUCTION WORKING STREAMWISE ALONG A     VORLAX  2313
      C...GIVEN STRIP, STRIP BY STRIP, I.E., THE OUTER 210-LOOP REFERS TO   VORLAX  2314
      C...A CHORDWISE STRIP OF HORSESHOE VORTICES, AND THE INNER 210-LOOP   VORLAX  2315
      C...RELATES TO A PARTICULAR HORSESHOE ON THE STRIP.                   VORLAX  2316
      C                                                                   VORLAX  2317
```

```
C                                                                   VORLAX    2318
      DO 210 K = 1, NT                                              VORLAX    2319
C                                                                   VORLAX    2320
C...COMPUTE PARAMETERS COMMON TO A GIVEN CHORDWISE STRIP OF HORSESHOE VORLAX    2321
C...VORTICES.                                                       VORLAX    2322
C                                                                   VORLAX    2323
      PION2 = PI *.5 /RNMAX (K)                                     VORLAX    2324
      PION3 = 0.5 *PION2                                            VORLAX    2325
      PION4 = PION2 /8.0                                            VORLAX    2326
      DELX = CHORD (K) /RNMAX (K)                                   VORLAX    2327
      WEIGHT = 1.0                                                  VORLAX    2328
      WT1 = 0.25 *DELX                                              VORLAX    2329
      CDL = COS (DTR *DL (K))                                       VORLAX    2330
      SDL = SIN (DTR *DL (K))                                       VORLAX    2331
      COS1 = COS (DTR *(DL (K1) - DL (K)))                          VORLAX    2332
      SIN1 = SIN (DTR *(DL (K1) - DL (K)))                          VORLAX    2333
      COS2 = COS (DTR *(DL (K1) + DL (K)))                          VORLAX    2334
      SIN2 = SIN (DTR *(DL (K1) + DL (K)))                          VORLAX    2335
      COSIN = COS (2.0 *DTR *DL (K))                                VORLAX    2336
      SININ = SIN (2.0 *DTR *DL (K))                                VORLAX    2337
      MAX2 = RNMAX (K)                                              VORLAX    2338
C                                                                   VORLAX    2339
      AA = FAL *CDL - FBL *SDL                                      VORLAX    2340
      AM = FBL *CDL + FAL *SDL                                      VORLAX    2341
C                                                                   VORLAX    2342
C                                                                   VORLAX    2343
   40 DO 210  J = 1, MAX2                                           VORLAX    2344
      IR = IR + 1                                                   VORLAX    2345
      XLOAD  = X (IR)                                               VORLAX    2346
      X1 = XCNTL - XLOAU                                            VORLAX    2347
      YP = YCNTL + YY (IR)                                          VORLAX    2348
      YS = YCNTL - YY (IR)                                          VORLAX    2349
      ZS = ZCNTL - ZZ (IR)                                          VORLAX    2350
      Y1 = YS *CDL + ZS *SDL                                        VORLAX    2351
      Z1 = ZS *CDL - YS *SDL                                        VORLAX    2352
      Y2 = YP *CDL - ZS *SDL                                        VORLAX    2353
      Z2 = ZS *CDL + YP *SDL                                        VORLAX    2354
      RYZ1 = Y1 *Y1 + Z1 *Z1                                        VORLAX    2355
      RYZ2 = Y2 *Y2 + Z2 *Z2                                        VORLAX    2356
      X1SQ = X1 *X1                                                 VORLAX    2357
      RS1 = X1SQ - B2 *RYZ1                                         VORLAX    2358
      RS2 = X1SQ - B2 *RYZ2                                         VORLAX    2359
      IF (RS1 .GT. 0.0) RS1 = SQRT (RS1)                            VORLAX    2360
      IF (RS2 .GT. 0.0) RS2 = SQRT(RS2)                             VORLAX    2361
      IF (LAX .EQ. 1) GO TO 50                                      VORLAX    2362
      RJ = 2 *J - 1                                                 VORLAX    2363
      RJ1 = 4 *J - 3                                                VORLAX    2364
      DELX = 1.0                                                    VORLAX    2365
      WEIGHT = PIUN2 *SIN (RJ *PION2) *CHORD (K)                    VORLAX    2366
      WT1 = PION3 *SIN (RJ1 *PION3) *CHORD (K)                      VORLAX    2367
   50 XU1 = XLOAD - WT1                                             VORLAX    2368
      CT = XTE (K) - XLOAD                                          VORLAX    2369
      TESP = TNT (K)                                                VORLAX    2370
      ESP = VSP (IR)                                                VORLAX    2371
      VOSS = VST (IR)                                               VORLAX    2372
      TOLZ = WEIGHT *DELX *1.0E-1                                   VORLAX    2373
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      C...RADIUS (RNF) OF SENDING ELEMENT, THEN COMPUTE AXIALWASH (U1) BY    VORLAX    2376
      C...INTERDIGITATED VORTEX SPLITTING.                                   VORLAX    2377
      C                                                                      VORLAX    2378
            UVEL = 0.0                                                       VORLAX    2379
            IDIT = 0                                                         VORLAX    2380
            RNF = 4.0 *WEIGHT *DELX                                          VORLAX    2381
            IF (SX (IR) .EQ. SX (IRR)) GO TO 90                              VORLAX    2382
            IF (RS1 .LE. 0.0) GO TO 90                                       VORLAX    2383
            IF (RS1 .GT. RNF) GO TO 90                                       VORLAX    2384
            RJM = J - 1                                                      VORLAX    2385
            COSM = COS (2.0 *PION2 *RJM)                                     VORLAX    2386
            DO 80 L = 1, 8                                                   VORLAX    2387
            IF (LAX .EQ. 0) GO TO 60                                         VORLAX    2388
            RVL = 4 *L - 3                                                   VORLAX    2389
            XDIF = RVL *DELX /32.0                                           VORLAX    2390
            WFR = 0.1250                                                     VORLAX    2391
            GO TO 70                                                         VORLAX    2392
       60   RVL = 16 *(J - 1) + 2 *L - 1                                     VORLAX    2393
            XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                 VORLAX    2394
            WFR = PION4 *SIN (PION4 *RVL)                                    VORLAX    2395
       70   XINT = XCNTL - X1 - XDIF                                         VORLAX    2396
            CALL UXVEL (XINT, Y1, Z1, VOSS, ESP, B2, TOLZ, UDV)              VORLAX    2397
            UVEL = UVEL + UDV *WFR                                           VORLAX    2398
       80   CONTINUE                                                         VORLAX    2399
            DCW = 1.0                                                        VORLAX    2400
            IF (LAX .EQ. 0)  DCW = CHORD (K) /WEIGHT                         VORLAX    2401
            UVEL = UVEL * DCW                                                VORLAX    2402
            IDIT = 1                                                         VORLAX    2403
      C                                                                      VORLAX    2404
      C...SUBROUTINE WASH COMPUTES THE VELOCITIES INDUCED BY A GENERALIZED   VORLAX    2405
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      C                                                                      VORLAX    2407
       90   CALL WASH (X1,Y1,Z1,VOSS,ESP,B2,U1,V1,W1,AA,AM,TESP,CT,MM)       VORLAX    2408
            IF (IDIT .EQ. 1) U1 = UVEL                                       VORLAX    2409
      C                                                                      VORLAX    2410
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      C...GROUND PLANE.                                                      VORLAX    2413
      C                                                                      VORLAX    2414
            IF (HAG .EQ. 0.0) GO TO 100                                      VORLAX    2415
            XIM = XIMO + X (IR) *CO2A + ZZ (IR) *SI2A                        VORLAX    2416
            ZIM = ZIMO + X (IR) *SI2A - ZZ (IR) *CO2A                        VORLAX    2417
            XII = XCNTL - XIM                                                VORLAX    2418
            ZSI = ZCNTL - ZIM - XII *TAN2A                                   VORLAX    2419
            YII = YS *CDL - ZSI *SDL                                         VORLAX    2420
            ZII = ZSI *CDL + YS *SDL                                         VORLAX    2421
            CALL WASH (XII,YII,ZII,VOSS,ESP,B2,UII,VII,WII,AA,AM,TESP,CT,MM) VORLAX    2422
            U1 = U1 - UII                                                    VORLAX    2423
            V1 = V1 - VII *COSIM - WII *SINIM                                VORLAX    2424
            W1 = W1 + VII *SINIM - WII *COSIM                                VORLAX    2425
      100   IF (LATRAL .EQ. 1) GO TO 160                                     VORLAX    2426
      C                                                                      VORLAX    2427
      C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL THEN         VORLAX    2428
      C...COMPUTE INFLUENCE OF HORSESHOE VORTEX IMAGE MIRRORED ABOUT         VORLAX    2429
      C...CENTER PLANE, I.E., X-Z PLANE.                                     VORLAX    2430
      C                                                                      VORLAX    2431
      UVEL = 0.0                                                        VORLAX  2432
      IDIT = 0                                                          VORLAX  2433
      IF (RS2 .LE. 0.0) GO TO 140                                       VORLAX  2434
      IF (RS2 .GT. RNF) GO TO 140                                       VORLAX  2435
      RJM = J - 1                                                       VORLAX  2436
      COSM = COS (2.0 *PION2 *RJM)                                      VORLAX  2437
      DO 130 L = 1, 8                                                   VORLAX  2438
      IF (LAX .EQ. 0) GO TO 110                                         VORLAX  2439
      RVL = 4 *L - 3                                                    VORLAX  2440
      XDIF = RVL *DELX /32.0                                            VORLAX  2441
      WFR = 0.1250                                                      VORLAX  2442
      GO TO 120                                                         VORLAX  2443
  110 RVL = 16 *(J - 1) + 2 *L - 1                                      VORLAX  2444
      XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                  VORLAX  2445
      WFR = PION4 *SIN (PION4 *RVL)                                     VORLAX  2446
  120 XINT = XCNTL - XU1 - XDIF                                         VORLAX  2447
      CALL UXVEL (XINT, Y2, Z2, VOSS, -ESP, B2, TOLZ, UDV)              VORLAX  2448
      UVEL = UVEL + UDV *WFR                                            VORLAX  2449
  130 CONTINUE                                                          VORLAX  2450
      DCW = 1.0                                                         VORLAX  2451
      IF (LAX .EQ. 0) DCW = CHORD (K) /WEIGHT                           VORLAX  2452
      UVEL = UVEL *DCW                                                  VORLAX  2453
      IDIT = 1                                                          VORLAX  2454
C                                                                       VORLAX  2455
  140 CALL WASH (X1,Y2,Z2,VOSS, - ESP,B2,U2,V2,W2,AA,AM, -TESP,CT,MM)   VORLAX  2456
      IF (IDIT .EQ. 1) U2 = UVEL                                        VORLAX  2457
C                                                                       VORLAX  2458
      IF  (HAG  .EQ. 0.0) GO TO 150                                     VORLAX  2459
C                                                                       VORLAX  2460
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL, AND          VORLAX  2461
C...CONFIGURATION IS IN GROUND EFFECT, THEN COMPUTE INFLUENCE OF        VORLAX  2462
C...DOUBLE-MIRRORED HORSESHOE IMAGE (ONCE ABOUT CENTER PLANE, AND       VORLAX  2463
C...ANOTHER ABOUT GROUND PLANE).                                        VORLAX  2464
C                                                                       VORLAX  2465
      Y2I  = YP *CDL  + ZSI *SDL                                        VORLAX  2466
      Z2I  = ZSI *CDL  - YP *SDL                                        VORLAX  2467
      CALL WASH(X1I,Y2I,Z2I,VOSS,- ESP,B2,U2I,V2I,W2I,AA,AM,-TESP,CT,MM) VORLAX  2468
      U2 = U2 - U2I                                                     VORLAX  2469
      V2 = V2 - V2I *COSIM + W2I *SINIM                                 VORLAX  2470
      W2 = W2 - V2I *SINIM - W2I *COSIM                                 VORLAX  2471
C                                                                       VORLAX  2472
  150 EW (IR) = (W1 *COS1 + W2 *COS2 - V1 *SIN1 - V2 *SIN2) *WEIGHT     VORLAX  2473
      EU (IR) = (U1 + U2) *WEIGHT                                       VORLAX  2474
      GO TO 170                                                         VORLAX  2475
C                                                                       VORLAX  2476
  160 EW (IR) = (W1 *COS1 - V1 *SIN1) *WEIGHT                           VORLAX  2477
      EU (IR) = U1 *WEIGHT                                              VORLAX  2478
  170 IF (JJ1 .EQ. 1) GO TO 210                                         VORLAX  2479
C                                                                       VORLAX  2480
  180 ENORM = EW (IR) *COSINE + EU (IR) *SINE                           VORLAX  2481
      ETAN = EW (IR) *SINE + EU (IR) *COSINE                            VORLAX  2482
      EW (IR) = ENORM                                                   VORLAX  2483
      EU (IR) = ETAN                                                    VORLAX  2484
C                                                                       VORLAX  2485
      IF  (IR  .NE. IRR) GO TO 190                                      VORLAX  2486
      EW (IR) = EW (IR) + WWAVE                                         VORLAX  2487
  190 CONTINUE                                                          VORLAX  2488
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                IF  (FLAG .EQ. 0) GO TO 210                           VORLAX   2489
                IF (INVERS .EQ. 1) GO TO 210                          VORLAX   2490
          C                                                           VORLAX   2491
          C...IF CONTROL POINT BELONGS TO A SONIC HORSESHOE VORTEX, AND THE   VORLAX   2492
          C...SENDING ELEMENT IS SUCH HORSESHOE, THEN MODIFY THE NORMALWASH   VORLAX   2493
          C...COEFFICIENTS IN SUCH A WAY THAT THE STRENGTH OF THE SONIC VORTEX  VORLAX   2494
          C...WILL BE THE AVERAGE OF THE STRENGTHS OF THE HORSESHOES IMMEDIATELY VORLAX   2495
          C...IN FRONT OF AND BEHIND IT.                              VORLAX   2496
          C                                                           VORLAX   2497
                RCC = 0.                                              VORLAX   2498
                IF (K .NE. K1) GO TO 200                              VORLAX   2499
                IF (IABS (J - J1) .GT. 1) GO TO 200                   VORLAX   2500
                RCC = - 1.0                                           VORLAX   2501
                IF (J .EQ. J1) RCC = 2.0                              VORLAX   2502
            200 EW (IR) = RCC                                         VORLAX   2503
            210 CONTINUE                                              VORLAX   2504
          C                                                           VORLAX   2505
          C                                                           VORLAX   2506
                IF  (JJ1  .GT. 1) GO TO 220                           VORLAX   2507
                WRITE  (9) EW                                         VORLAX   2508
                GO TO 230                                             VORLAX   2509
            220 WRITE (1) EW                                          VORLAX   2510
                WRITE (2) EU                                          VORLAX   2511
                IRR = IRR + 1                                         VORLAX   2512
            230 CONTINUE                                              VORLAX   2513
          C                                                           VORLAX   2514
          C                                                           VORLAX   2515
          C                                                           VORLAX   2516
                REWIND 1                                              VORLAX   2517
                REWIND 2                                              VORLAX   2518
                REWIND 9                                              VORLAX   2519
          C                                                           VORLAX   2520
          C                                                           VORLAX   2521
                RETURN                                                VORLAX   2522
                END                                                   VORLAX   2523


     SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  MATRX3

VARIABLES   SN    TYPE          RELOCATION
 1231  AA          REAL    REAL                          20  ALFA      REAL     REA          SET11
   10  ALPHA       REAL        ARRAY     SET11         1232  AM        REAL
    1  BETA        REAL                  SET15            0  A2        REAL                  SET15
    2  CBAR        REAL                  SET15         1220  COL       REAL
    0  CHORD       REAL        ARRAY     SET10         1226  COSIM     REAL
 1176  COSINE      REAL                                1265  COSM      REAL
 1222  COSI        REAL                                1224  COS2      REAL
 1161  COX         REAL                                1150  CO2A      REAL
 1254  CT          REAL                                   0  CX        INTEGER    ARRAY      SET3
    0  DCP         REAL        ARRAY     SET2          1274  DCW       REAL
 1167  DELTAX      REAL                                1215  DELX      REAL
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        SUBROUTINE MATRX        74/74    OPT=1                            FTN 4.5+410A       10/04/76  10.15.13        PAGE     8

VARIABLES       SN  TYPE                 RELOCATION
    144  DL          REAL         ARRAY    SET10          1142  DTR        REAL
   1321  ENORM       REAL                                 1256  ESP        REAL
   1204  ESPA        REAL                                 1202  ESPF       REAL
   1200  ESP1        REAL                                 1322  ETAN       REAL
      0  EU          REAL         ARRAY     F.P.             0  EW         REAL        ARRAY      F.P.
   1144  FAL         REAL                                 1145  FHL        REAL
   1140  FLAG        INTEGER                              1143  FLAX       REAL
     12  FLOATX      REAL                  / /              13  FLOATY     REAL                   / /
     11  HAG         REAL                  / /            1151  HIM        REAL
  13560  IDES        INTEGER      ARRAY    SET3           1262  IDIT       INTEGER
      3  IM          INTEGER               / /             404  INTRAC     INTEGER     ARRAY      SET20
     14  INVERS      INTEGER               / /            1130  IPAN       INTEGER     ARRAY      SET10
      2  IQ          INTEGER               / /            1210  IR         INTEGER
   1155  IRR         INTEGER                              1172  IRRA       INTEGER
   1171  IRRB        INTEGER                                15  ISOLV      INTEGER                / /
      0  ITOTAL      INTEGER                F.P.           170  ITS        INTEGER     ARRAY      SET7
   1233  J           INTEGER                              1164  JJ1        INTEGER
    214  JTS         INTEGER      ARRAY    SET7           1165  J1         INTEGER
   1211  K           INTEGER                              1157  KEY        INTEGER
   1156  K1          INTEGER                              1266  L          INTEGER
      4  LATRAL      INTEGER               / /               0  LAX        INTEGER                / /
      1  LAY         INTEGER               / /               0  MACH       INTEGER     ARRAY      SET11
   1160  MAX         INTEGER                              1163  MAXIM      INTEGER
   1230  MAX2        INTEGER                              1146  MM         INTEGER
     23  NALPHA      INTEGER               SET11            22  NMACH      INTEGER                SET11
      0  NPAN        INTEGER               SET14             3  NPANAS     INTEGER                SET14
    360  NPP         INTEGER      ARRAY    SET20             1  NT         INTEGER                SET14
     50  PHIMED      REAL         ARRAY    SET20          1141  PI         REAL
   1162  PION        REAL                                 1212  PION2      REAL
   1213  PION3       REAL                                 1214  PION4      REAL
      6  PITCHQ      REAL                  / /               5  PSI        REAL                   / /
   1173  RATIO       REAL                                 1323  RCC        REAL
    214  RCS         REAL         ARRAY    SET20          7640  RFLAG      REAL        ARRAY      SET3
   1252  RJ          REAL                                 1264  RJM        REAL
   1166  RJ1         REAL                                    0  RNCV       REAL        ARRAY      SET7
   1263  RNF         REAL                                   24  RNMAX      REAL        ARRAY      SET7
      7  ROLLQ       REAL                  / /            1250  RS1        REAL
   1251  RS2         REAL                                 1267  RVL        REAL
   1245  RYZ1        REAL                                 1246  RYZ2       REAL
   1221  SDL         REAL                                 1177  SINE       REAL
   1227  SINIM       REAL                                 1223  SIN1       REAL
   1225  SIN2        REAL                                 1147  SI2A       REAL
   3720  SLOPE       REAL         ARRAY    SET2              2  SMAX       REAL                   SET14
   3720  SX          INTEGER      ARRAY    SET3           1154  TAN2A      REAL
   1255  TESP        REAL                                  454  TNL        REAL        ARRAY      SET10
    620  TNT         REAL         ARRAY    SET10          1260  TOLZ       REAL
   1206  TRANS       REAL                                 1201  T2         REAL
   1205  T2A         REAL                                 1203  T2F        REAL
   1273  UDV         REAL                                 1261  UVEL       REAL
   1275  U1          REAL                                 1306  U11        REAL
   1311  U2          REAL                                 1316  U21        REAL
     21  VINF        REAL                  SET11          1257  VOSS       REAL
   7640  VSP         REAL         ARRAY    SET2            310  VSS        REAL        ARRAY      SET10
  10270  VST         REAL         ARRAY    SET20          1276  V1         REAL
   1307  V11         REAL                                 1312  V2         REAL
   1317  V21         REAL                                 1216  WEIGHT     REAL
   1271  WFR         REAL                                 1217  WT1        REAL
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        SUBROUTINE MATRX       74/74    OPT=1                                FTN 4.5+410A       10/04/76  10.15.13       PAGE      9

VARIABLES      SN   TYPE              RELOCATION
  1207  WWAVE        REAL                                          1277  W1          REAL
  1310  W1I          REAL                                          1313  W2          REAL
  1320  W2I          REAL                                             0  X           REAL        ARRAY     SET1
     3  XBAR         REAL                 SET15                    1170  XCNTL       REAL
  1270  XDIF         REAL                                          1300  XIN         REAL
  1152  XINO         REAL                                          1272  XINT        REAL
  1234  XLOAD        REAL                                           764  XTE         REAL        ARRAY     SET10
  1253  XU1          REAL                                          1235  X1          REAL
  1302  X1I          REAL                                          1247  X1SG        REAL
  3720  Y            REAL       ARRAY     SET1                       10  YAWQ        REAL                  / /
  1174  YCNTL        REAL                                          1236  YP          REAL
  1237  YS           REAL                                           430  YY          REAL        ARRAY     SET20
  1241  Y1           REAL                                          1304  Y1I         REAL
  1243  Y2           REAL                                          1314  Y2I         REAL
  4064  Z            REAL       ARRAY     SET1                        4  ZBAR        REAL                  SET15
  4230  ZC           REAL       ARRAY     SET1                     1175  ZCNTL       REAL
  1301  ZIN          REAL                                          1153  ZINO        REAL
     0  ZLE1         REAL       ARRAY     SET20                      24  ZLE2        REAL        ARRAY     SET20
  1240  ZS           REAL                                          1303  ZSI         REAL
  4350  ZZ           REAL       ARRAY     SET20                    1242  Z1          REAL
  1305  Z1I          REAL                                          1244  Z2          REAL
  1315  Z2I          REAL

FILE NAMES         MODE
       TAPE1       UNFMT                 TAPE2      UNFMT                    TAPE9      UNFMT

EXTERNALS          TYPE     ARGS
       COS         REAL        1 LIBRARY                        SIN         REAL        1 LIBRARY
       SQRT        REAL        1 LIBRARY                        UXVEL                   8
       WASH                   14

INLINE FUNCTIONS   TYPE     ARGS
       IABS        INTEGER     1   INTRIN

STATEMENT LABELS
   160   10                                        202   20                                214   30
     0   40         INACTIVE                       360   50                                423   60
   440   70                                          0   80                                462   90
   525  100                                        551  110                                566  120
     0  130                                        611  140                                645  150
   660  160                                        666  170                                  0  180          INACTIVE
   702  190                                        715  200                                717  210
   734  220                                        750  230

LOOPS  LABEL      INDEX      FROM-TO     LENGTH     PROPERTIES
   65  230      * K1           95 367      670B                EXT REFS  NOT INNER
   77  230      * JJ1         102 367      654B                EXT REFS  NOT INNER
  216  210      * K           173 350      506B                EXT REFS  NOT INNER
  300  210      * J           198 358      422B                EXT REFS  NOT INNER
  413  80       * L           241 253       37B                EXT REFS
  541  130      * L           292 304       40B                EXT REFS

COMMON BLOCKS    LENGTH
       / /           14
       SET1        2250
       SET2        6000
       SET3        8000
```

```
COMMON BLOCKS   LENGTH
       SET7        240
       SET10       700
       SET11        20
       SET14         4
       SET15         5
       SET20      6280

STATISTICS
  PROGRAM LENGTH                 13458      741
  CM LABELED COMMON LENGTH      557138    23499
  CM BLANK COMMON LENGTH           16B       14
```

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      CONTROL*VRLX.PRESS                                         9/15/76  VORLAX    2524
      C...                                                                VORLAX    2525
            SUBROUTINE PRESS (ITOTAL, EU)                                 VORLAX    2526
      C                                                                   VORLAX    2527
      C                                                                   VORLAX    2528
      C...PURPOSE    TO COMPUTE PRESSURE LOAD COEFFICIENTS (CPLOWER       VORLAX    2529
      C...           CPUPPER), OR SURFACE PRESSURE COEFFICIENTS, FROM THE VORLAX    2530
      C...           VALUES OF THE INDUCED VELOCITIES AND CIRCULATION     VORLAX    2531
      C...           STRENGTHS.                                           VORLAX    2532
      C...                                                                VORLAX    2533
      C...INPUT      CALLING SEQUENCES                                    VORLAX    2534
      C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.         VORLAX    2535
      C...           EU = AXIALWASH INFLUENCE COEFFICIENT MATRIX (RETRIEVED VORLAX  2536
      C...                ROW BY ROW FROM UNIT 2).                        VORLAX    2537
      C...           COMMONS                                              VORLAX    2538
      C...           B2, CX, DL, SX, JTS, PSI, TNL, TNT, ALFA, YAWQ, CHORD, VORLAX  2539
      C...           GAMMA, ONSET, RNMAX, SLOPE, WSPAN.                   VORLAX    2540
      C...                                                                VORLAX    2541
      C...OUTPUT     CALLING SEQUENCES                                    VORLAX    2542
      C...           NONE.                                                VORLAX    2543
      C...           COMMONS                                              VORLAX    2544
      C...           DCP.                                                 VORLAX    2545
      C...                                                                VORLAX    2546
      C...SUBROUTINES                                                     VORLAX    2547
      C...CALLED     NONE.                                                VORLAX    2548
      C...                                                                VORLAX    2549
      C...DISCUSSION THIS SUBROUTINE COMPUTES THE PRESSURE COEFFICIENT ARRAY VORLAX 2550
      C...           DCP. EACH ELEMENT OF DCP CORRESPONDS TO A GIVEN      VORLAX    2551
      C...           HORSESHOE VORTEX OF THE LATTICE, AND IT IS ASSUMED TO VORLAX   2552
      C...           ACT AT THE HORSESHOE CENTROID, I.E., THE MI=         VORLAX    2553
      C...           THE TRANSVERSE, OR SKEWED, LEG. AN ELEMENT OF THE DCP VORLAX   2554
      C...           ARRAY IS EITHER A LOAD COEFFICIENT (IF THE SURFACE   VORLAX    2555
      C...           IS ASSUMED WETTED ON BOTH FACES, I.E., JTS = ITS = 1), VORLAX  2556
      C...           OR A SURFACE PRESSURE COEFFICIENT (IF THE SURFACE IS VORLAX    2557
      C...           ASSUMMED WETTED ON ONE SIDE ONLY, I.E., JTS = ITS = 0). VORLAX 2558
      C...           IN THE COMPUTATION OF LOAD COEFFICIENTS, THE CIRCULA VORLAX    2559
      C...           TION STRENGTHS, THE FREE STREAM VELOCITY COMPONENTS, VORLAX    2560
      C...           AND THE ONSET FLOW DUE TO ANY ANGULAR ROTATION OF THE VORLAX   2561
      C...           CONFIGURATION ARE TAKEN INTO ACCOUNT, THE EFFECT OF  VORLAX    2562
      C...           THE INDUCED AXIALWASH IS IGNORED (SECOND ORDER ERROR). VORLAX  2563
      C...           IN THE COMPUTATION OF SURFACE PRESSURE COEFFICIENTS, VORLAX    2564
      C...           THE AXIALWASH IS ALSO TAKEN INTO ACCOUNT. IF NPP = 1, VORLAX   2565
      C...           THE *AXIALWASH* IS NO LONGER A TRUE AXIALWASH (X-AXIS VORLAX   2566
      C...           VELOCITY COMPONENT), RATHER IT REPRESENTS THE VELOCITY VORLAX  2567
      C...           COMPONENT TANGENTIAL TO THE SURFACE BUT WITH THE SIDE VORLAX   2568
      C...           WASH LEFT OUT. SURFACE PRESSURE COEFFICIENTS ARE LIMI VORLAX   2569
      C...           TED BY THE ISENTROPIC VALUES CORRESPONDING TO STAGNA VORLAX    2570
      C...           TION AND 70 PERCENT OF VACUUM FOR THE GIVEN FREE-STREAM VORLAX 2571
      C...           MACH NUMBER.                                         VORLAX    2572
      C...                                                                VORLAX    2573
      C...                                                                VORLAX    2574
      C                                                                   VORLAX    2575
            COMMON LAX, LAY, IQ, IM, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG, VORLAX  2576
           * FLOATX, FLOATY, INVERS                                       VORLAX    2577
            COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)            VORLAX    2578
            COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000) VORLAX    2579
            COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)     VORLAX    2580
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),         VORLAX   2581
     * TNT (100), XTE (100), IPAN (100)                                  VORLAX   2582
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA      VORLAX   2583
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , WSPAN, HLM                 VORLAX   2584
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                          VORLAX   2585
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (2000)                     VORLAX   2586
      INTEGER CX, SX                                                     VORLAX   2587
C                                                                        VORLAX   2588
      DIMENSION EU (ITOTAL)                                              VORLAX   2589
C                                                                        VORLAX   2590
      REWIND 2                                                           VORLAX   2591
C                                                                        VORLAX   2592
      PI = 3.14159                                                       VORLAX   2593
      DTR = 0.01745329                                                   VORLAX   2594
C                                                                        VORLAX   2595
C...COMPUTE ISENTROPIC FLOW PARAMETERS AND CUTOFF VALUES FOR             VORLAX   2596
C...SURFACE PRESSURE COEFFICIENTS (CPSTAG AND CPVAC).                    VORLAX   2597
C                                                                        VORLAX   2598
      CPSTAG = 1.0                                                       VORLAX   2599
      XM1 = 1.0                                                          VORLAX   2600
      XM2 = 0.0                                                          VORLAX   2601
      XM3 = 1.0                                                          VORLAX   2602
      XM4 = 1.0                                                          VORLAX   2603
      XM5 = 0.0                                                          VORLAX   2604
      CPVAC = - 142.86                                                   VORLAX   2605
      IF (B2 .LT. -.98) GO TO 10                                         VORLAX   2606
C                                                                        VORLAX   2607
      CPSTAG = ((1.2 + .2 *B2) **3.5 - 1.) /(.7*(1.+B2))                 VORLAX   2608
      CPVAC = - 1.0 /(1.0 + B2)                                          VORLAX   2609
      XM1 = 1.4286 /(1.0 + B2)                                           VORLAX   2610
      XM2 = 1.0                                                          VORLAX   2611
      XM3 = 0.2 *(1.0 + B2)                                              VORLAX   2612
      XM4 = 3.5                                                          VORLAX   2613
      XM5 = 1.0                                                          VORLAX   2614
C                                                                        VORLAX   2615
 10   CONTINUE                                                           VORLAX   2616
C                                                                        VORLAX   2617
C                                                                        VORLAX   2618
C...COMPUTE FREE-STREAM AND ONSET FLOW PARAMETERS.                       VORLAX   2619
C                                                                        VORLAX   2620
      YAW = DTR *YAWQ *2.0 /WSPAN                                        VORLAX   2621
      COSALF = 1.0 /SQRT (1. + ALFA **2)                                 VORLAX   2622
      SINPSI = SIN (DTR *PSI)                                            VORLAX   2623
      COPSI = COS (DTR *PSI)                                             VORLAX   2624
      FORAXL = COSALF *COPSI                                             VORLAX   2625
      FORLAT = COSALF *SINPSI *2.0                                       VORLAX   2626
      FLAX = LAX                                                         VORLAX   2627
C                                                                        VORLAX   2628
      DO 90 IR = 1, ITOTAL                                               VORLAX   2629
      KC = CX (IR)                                                       VORLAX   2630
      KS = SX (IR)                                                       VORLAX   2631
      RC = KC                                                            VORLAX   2632
      RS = RC                                                            VORLAX   2633
      PION = PI /RNMAX (KS)                                              VORLAX   2634
      MAX = RNMAX (KS)                                                   VORLAX   2635
      DCPSID = 0.0                                                       VORLAX   2636
      IF (PSI .EQ. 0.0) GO TO 40                                         VORLAX   2637
```

```
C                                                                       VORLAX   2638
C...COMPUTE EFFECT OF SIDESLIP.                                         VORLAX   2639
C                                                                       VORLAX   2640
      XIA = 0.5 *(1. - COS ((RC - 1.) *PION)) *(1. - FLAX)              VORLAX   2641
      XIA = XIA + (RC - 1.0) /RNMAX (KS) *FLAX                          VORLAX   2642
      XIB = 0.5 * (1. - COS (RC *PION)) *(1. - FLAX)                    VORLAX   2643
      XIB = XIB + RC /RNMAX (KS) *FLAX                                  VORLAX   2644
      TANA = TNL (KS) *(1. - XIA) + TNT (KS) *XIA                       VORLAX   2645
      TANB = TNL (KS) *(1. - XIB) + TNT (KS) *XIB                       VORLAX   2646
      KTOP = KC - 1                                                     VORLAX   2647
      GANT = 0.0                                                        VORLAX   2648
      IF (KTOP .EQ. 0) GO TO 30                                         VORLAX   2649
      DO 20 KK = 1, KTOP                                                VORLAX   2650
      KIR = IR - KC + KK                                                VORLAX   2651
      RKK = KK                                                          VORLAX   2652
      GFX = .5 *PION *SIN ((RKK - .5) *PION) *(1. - FLAX)               VORLAX   2653
      GFX = GFX + FLAX /CHORD (KS)                                      VORLAX   2654
      GANT = GANT + GFX *GAMMA (KIR)                                    VORLAX   2655
   20 CONTINUE                                                          VORLAX   2656
   30 GLAT = GANT *(TANA - TANB)                                        VORLAX   2657
      GFX = .5 *PION *SIN ((RC - .5) *PION) *(1. - FLAX)                VORLAX   2658
      GFX = GFX + FLAX /CHORD (KS)                                      VORLAX   2659
      GLAT = GLAT - GFX *GAMMA (IR) *TANB                               VORLAX   2660
      DCPSID = FORLAT *COS (DTR *DL (KS)) *GLAT /(XIB - XIA)            VORLAX   2661
   40 FACTOR = FORAXL + ONSET (IR)                                      VORLAX   2662
C                                                                       VORLAX   2663
C...COMPUTE LOAD COEFFICIENT.                                           VORLAX   2664
C                                                                       VORLAX   2665
      GNET = GAMMA (IR) *FACTOR                                         VORLAX   2666
      IF (LAX .EQ. 1) GNET = GNET *RNMAX (SX (IR)) /CHORD (SX (IR))     VORLAX   2667
      DCP (IR) = 2.0 *GNET + DCPSID                                     VORLAX   2668
C                                                                       VORLAX   2669
      READ (2) EU                                                       VORLAX   2670
      IF (JTS (SX (IR)) .EQ. 0) GO TO 90                                VORLAX   2671
C                                                                       VORLAX   2672
C                                                                       VORLAX   2673
C...COMPUTATION OF SURFACE PRESSURE COEFFICIENT.                        VORLAX   2674
C                                                                       VORLAX   2675
C                                                                       VORLAX   2676
C...COMPUTE TOTAL INDUCED AXIALWASH AT CONTROL POINT RELATED TO         VORLAX   2677
C...HORSESHOE VORTEX UNDER CONSIDERATION (UB).                          VORLAX   2678
C                                                                       VORLAX   2679
      UB = 0.0                                                          VORLAX   2680
      DO 50 IRR = 1, ITOTAL                                             VORLAX   2681
      UBF = EU (IRR)                                                    VORLAX   2682
      UB = UB + UBF *GAMMA (IRR)                                        VORLAX   2683
   50 CONTINUE                                                          VORLAX   2684
C                                                                       VORLAX   2685
      F2 = UB                                                           VORLAX   2686
C                                                                       VORLAX   2687
      FS2 = SLOPE (IR)                                                  VORLAX   2688
C                                                                       VORLAX   2689
      IF (KC  .EQ. 1) GO TO 80                                          VORLAX   2690
C                                                                       VORLAX   2691
C...COMPUTE AXIALWASH AT VORTEX CENTROID (LOAD POINT) BY INTERPOLATING  VORLAX   2692
C...(EXTRAPOLATING FOR THE FIRST CHORDWISE ELEMENT) BETWEEN CONTROL     VORLAX   2693
C...POINTS.                                                             VORLAX   2694
```

```
C                                                                       VORLAX  2695
      IF  (LAX  .EQ. 1) GO TO 60                                        VORLAX  2696
      XX = .5 *(1.0 - COS ((RC  - 0.5) *PION))                          VORLAX  2697
      X1 = .5 *(1.0 - COS ((RC - 1.0) *PION))                           VORLAX  2698
      X2 = .5 *(1.0 - COS (RC *PION))                                   VORLAX  2699
      GO TO 70                                                          VORLAX  2700
   60 XX = (RC - 0.75) /RNMAX (KS)                                      VORLAX  2701
      X1 = (RC - 1.25) /RNMAX (KS)                                      VORLAX  2702
      X2 = (RC + 0.75) /RNMAX (KS)                                      VORLAX  2703
   70 UB = (XX - X2) /(X1 - X2) *F1 + (XX - X1)/ (X2 - X1) *F2          VORLAX  2704
C                                                                       VORLAX  2705
C...COMPUTE AXIALWASH DUE TO THE DISTRIBUTED VORTICITY WHICH HAS BEEN    VORLAX  2706
C...CONCENTRATED IN TRANSVERSE LEG OF THE HORSESHOE UNDER CONSIDERA      VORLAX  2707
C...TION (UG). THIS COMPONENT HAS NOT BEEN INCLUDED IN UB.               VORLAX  2708
C                                                                       VORLAX  2709
      UG = 0.25 *FLOAT (JTS (KS)) *DCP (IR)                             VORLAX  2710
C                                                                       VORLAX  2711
C...ADD UG TO FREE-STREAM X-VELOCITY COMPONENT, ACCOUNT FOR SURFACE      VORLAX  2712
C...INCLINATION IN ORDER TO OBTAIN TRUE TANGENTIAL COMPONENT, AND ADD    VORLAX  2713
C...TO UB TO COMPUTE TOTAL TANGENTIAL VELOCITY (VELOX). THIS IS ONLY     VORLAX  2714
C...AN APPROXIMATION BECAUSE SIDEWASH CONTRIBUTION IS NOT INCLUDED.      VORLAX  2715
C                                                                       VORLAX  2716
      FTAN = (XX - X2) /(X1 - X2) *FS1 + (XX - X1) /(X2 - X1) *FS2      VORLAX  2717
      FSQ = 1.0 /SQRT (1.0 + FTAN **2)                                  VORLAX  2718
      VELOX = UB + (UG + COSALF) *FSQ                                   VORLAX  2719
C                                                                       VORLAX  2720
C...COMPUTE SURFACE PRESSURE COEFFICIENT USING ISENTROPIC FLOW           VORLAX  2721
C...FLOW FORMULAS, AND APPLY ESTABLISHED PHYSICAL LIMITS (CPSTAG AND     VORLAX  2722
C...CPVAC) TO IT.                                                        VORLAX  2723
C                                                                       VORLAX  2724
      RADVEX = XM2 + XM3 *(1.0 - VELOX *VELOX)                          VORLAX  2725
      DCP (IR) = CPVAC                                                  VORLAX  2726
      IF (RADVEX .GT. 0.0) DCP (IR) = XM1 *(RADVEX **XM4 - XM5)         VORLAX  2727
      IF (B2 .LT. -.98) DCP (IR) = RADVEX                               VORLAX  2728
C                                                                       VORLAX  2729
      IF (KC .GT. 2) GO TO 80                                           VORLAX  2730
C                                                                       VORLAX  2731
C                                                                       VORLAX  2732
C...CARRY OUT COMPUTATIONS RELATED TO FIRST CHORDWISE ELEMENT.           VORLAX  2733
C...EXTRAPOLATE USING FIRST AND SECOND CHORDWISE CONTROL POINTS.         VORLAX  2734
C                                                                       VORLAX  2735
      XX = .5 * (1.0 - COS (0.5 *PION))                                 VORLAX  2736
      IF (LAX .EQ. 1) XX = 0.25 /RNMAX (KS)                             VORLAX  2737
      UB = (XX - X2) /(X1 - X2) *F1 + (XX - X1) /(X2 - X1) *F2          VORLAX  2738
      FTAN = (XX-X2) /(X1-X2) *FS1 + (XX-X1) /(X2-X1) *FS2              VORLAX  2739
      UG = 0.25 *FLOAT (JTS (KS)) *DCP (IR - KC + 1)                    VORLAX  2740
      FSQ = 1.0 /SQRT (1.0 + FTAN **2)                                  VORLAX  2741
      VELOX = UB + (UG + COSALF) *FSQ                                   VORLAX  2742
      RADVEX = XM2 + XM3 *(1.0 - VELOX *VELOX)                          VORLAX  2743
      DCP (IR - KC + 1) = CPVAC                                         VORLAX  2744
      IF (RADVEX .GT. 0.) DCP (IR - KC + 1) = XM1 *(RADVEX **XM4 - XM5) VORLAX  2745
      IF (B2 .LT. -.98)  DCP (IR - KC + 1) = RADVEX                     VORLAX  2746
C                                                                       VORLAX  2747
      IF (DCP (IR - KC + 1) .GT. CPSTAG) DCP (IR - KC + 1) = CPSTAG     VORLAX  2748
      IF (DCP (IR - KC + 1) .LT. CPVAC ) DCP (IR - KC + 1) = CPVAC      VORLAX  2749
C                                                                       VORLAX  2750
C...END OF COMPUTATIONS PARTICULAR TO FIRST CHORDISE ELEMENT ONLY.       VORLAX  2751
```

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                C                                                                        VORLAX    2752
  230            80    F1 = F2                                                           VORLAX    2753
                       FS1 = FS2                                                         VORLAX    2754
                       IF (KC .EQ. 1) GO TO 90                                           VORLAX    2755
                       IF (DCP (IR) .GT. CPSTAG) DCP (IR) = CPSTAG                       VORLAX    2756
                       IF (DCP (IR) .LT. CPVAC) DCP (IR) = CPVAC                         VORLAX    2757
  235           C                                                                        VORLAX    2758
                C                                                                        VORLAX    2759
                C...END OF SURFACE PRESSURE COEFFICIENT COMPUTATION                      VORLAX    2760
                C                                                                        VORLAX    2761
                C                                                                        VORLAX    2762
  240            90    CONTINUE                                                          VORLAX    2763
                C                                                                        VORLAX    2764
                       REWIND 2                                                          VORLAX    2765
                       RETURN                                                            VORLAX    2766
                       END                                                               VORLAX    2767


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  PRESS

VARIABLES      SN  TYPE            RELOCATION
    20  ALFA        REAL                 SET11         10  ALPHA     REAL        ARRAY    SET11
     1  BETA        REAL                 SET15          0  BIG       REAL                 SET13
     0  B2          REAL                 SET15          2  CHAR      REAL                 SET15
     0  CHORD       REAL       ARRAY     SET10        511  COPSI     REAL
   507  COSALF      REAL                              477  CPSTAG    REAL
   505  CPVAC       REAL                                0  CX        INTEGER     ARRAY    SET3
     0  DCP         REAL       ARRAY     SET2         524  DCPSID    REAL
   144  DL          REAL       ARRAY     SET10        476  DTR       REAL
     3  EPS         REAL                 SET13          0  FU        REAL        ARRAY     F.P.
   540  FACTOR      REAL                              514  FLAX      REAL
    12  FLOATX      REAL                 / /           13  FLOATY    REAL                 / /
   512  FORAXL      REAL                              513  FORLAT    REAL
   556  FS0         REAL                              555  FS1       REAL
   546  FS2         REAL                              554  FTAN      REAL
   552  F1          REAL                              545  F2        REAL
     0  GAMMA       REAL       ARRAY     SET16        532  GANT      REAL
   536  GFX         REAL                              537  GLAT      REAL
   541  GNET        REAL                               11  MAG       REAL                 / /
 13560  IDES        INTEGER    ARRAY     SET3           3  IM        INTEGER              / /
    14  INVERS      INTEGER              / /         1130  IPAN      INTEGER     ARRAY    SET10
     2  IQ          INTEGER              / /          515  IR        INTEGER
   543  IRR         INTEGER                             1  ITER      INTEGER              SET13
     0  ITOTAL      INTEGER               F.P.          2  ITRMAX    INTEGER              SET13
   170  ITS         INTEGER    ARRAY     SET7         214  JTS       INTEGER     ARRAY    SET7
   516  KC          INTEGER                           534  KIR       INTEGER
   533  KK          INTEGER                           517  KS        INTEGER
   531  KTOP        INTEGER                             4  LATRAL    INTEGER              / /
     0  LAX         INTEGER              / /            1  LAY       INTEGER              / /
     0  MACH        INTEGER    ARRAY     SET11        523  MAX       INTEGER
    23  NALPHA      INTEGER              SET11         22  NMACH     INTEGER              SET11
```

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        SUBROUTINE PRESS       74/74    OPT=1                              FTN 4.5+410A       10/04/76  10.15.13         PAGE       6

VARIABLES      SN  TYPE              RELOCATION
  3720  ONSET       REAL       ARRAY      SET16            475  PI           REAL
   522  PION        REAL                                     6  PITCHO       REAL                         / /
     5  PSI         REAL                  / /              560  RADVEX       REAL
   520  RC          REAL                                  7640  RFLAG        REAL          ARRAY      SET3
   535  RKK.        REAL                                     5  RLM          REAL                     SET13
     0  RNCV        REAL       ARRAY      SET7              24  RNMAX        REAL          ARRAY      SET7
     7  ROLLO       REAL                  / /              521  RS           REAL
   510  SINPSI      REAL                                  3720  SLOPE        REAL          ARRAY      SET2
  3720  SX          INTEGER    ARRAY      SET3             527  TANA         REAL
   530  TANB        REAL                                   454  TNL          REAL          ARRAY      SET10
   620  TNT         REAL       ARRAY      SET10            542  UB           REAL
   544  UBF         REAL                                   553  UG           REAL
   557  VELOX       REAL                                    21  VINF         REAL                     SET11
  7640  VSP         REAL       ARRAY      SET2             310  VSS          REAL          ARRAY      SET10
     4  WSPAN       REAL                  SET13              3  XBAR         REAL                     SET15
   525  XIA         REAL                                   526  XIB          REAL
   500  XM1         REAL                                   501  XM2          REAL
   502  XM3         REAL                                   503  XM4          REAL
   504  XM5         REAL                                   764  XTE          REAL          ARRAY      SET10
   547  XX          REAL                                   550  X1           REAL
   551  X2          REAL                                   506  YAW          REAL
    10  YAWO        REAL                  / /                4  ZBAR         REAL                     SET15

FILE NAMES         MODE
        TAPE2     UNFMT

EXTERNALS            TYPE    ARGS
        COS       REAL        1 LIBRARY                        SIN          REAL          1 LIBRARY
        SQRT      REAL        1 LIBRARY

INLINE FUNCTIONS     TYPE    ARGS
        FLOAT     REAL        1   INTRIN

STATEMENT LABELS
    47  10                                      0  20                                       156  30
   203  40                                      0  50                                       265  60
   274  70                                    426  80                                       441  90

LOOPS  LABEL     INDEX        FROM-TO     LENGTH     PROPERTIES
   71  90     * IR           106 240      153B                      EXT REFS  NOT INNER
  135  20     * KK           127 133       21B                      EXT REFS
  232  50       IRR          158 161        5B        INSTACK

COMMON BLOCKS    LENGTH
        / /           13
        SET2        6000
        SET3        8000
        SET7         240
        SET10        700
        SET11         20
        SET13          6
        SET15          5
        SET16       4000

STATISTICS
  PROGRAM LENGTH                     570B      376
  CM LABELED COMMON LENGTH         45033B    18971
```

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      SUBROUTINE PRESS        74/74    OPT=1                      FTN 4.5+410A        10/04/76  10.15.13         PAGE      7
STATISTICS
   CM BLANK COMMON LENGTH          15B       13
```

```
CONTROL*VRLX.PRINT                                              9/17/76  VORLAX   2768
C...                                                                     VORLAX   2769
      SUBROUTINE PRINT (ITOTAL, EW, EWX, EWY)                            VORLAX   2770
C...                                                                     VORLAX   2771
C...PURPOSE    TO PRINT PROGRAM DATA.                                    VORLAX   2772
C                                                                        VORLAX   2773
C...INPUT      CALLING SEQUENCE:                                         VORLAX   2774
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.              VORLAX   2775
C...           EW, EWX, EWY = STORAGE ARRAYS SET ASIDE FOR CALLING       VORLAX   2776
C...                          SUBROUTINE MAP.                            VORLAX   2777
C...           COMMON:                                                   VORLAX   2778
C...           CD, CL, CM, CN, CX, CY, DL, IH, IQ, YY, ZC, ZZ,           VORLAX   2779
C...           BIG, CDC, CNC, CRM, CYM, DCP, EPS, MAG, JTS, LAX,         VORLAX   2780
C...           NXS, PDL, PSI, RLM, SPC, CBAR, CMTC, CSUC, HEAD,          VORLAX   2781
C...           IPAN, ITER, LIFT, MACH, NPAN, NVOR, RNCV, SREF,           VORLAX   2782
C...           SURF, VINF, XBAR, XSUC, YAWQ, ZBAR, AINC1, AINC2,         VORLAX   2783
C...           ALPHA, CDTOT, CHORD, CLTOT, CMTOT, CNTOT, CYTOT,          VORLAX   2784
C...           DNDX1, DNDX2, GAMMA, ISOLV, LESWP, PSPAN, RNMAX,          VORLAX   2785
C...           ROLLQ, SLOPE, SYNTH, TAPER, TITLE, WSPAN, XAPEX,          VORLAX   2786
C...           YAPEX, ZAPEX, CSTART, FLOATX, FLOATY, INVERS,             VORLAX   2787
C...           IQUANT, ITRMAX, LATRAL, MOMENT, PITCHQ.                   VORLAX   2788
C...                                                                     VORLAX   2789
C...OUTPUT     CALLING SEQUENCE:                                         VORLAX   2790
C...           NONE.                                                     VORLAX   2791
C...           COMMON:                                                   VORLAX   2792
C...           NONE.                                                     VORLAX   2793
C...                                                                     VORLAX   2794
C...SUBROUTINES                                                          VORLAX   2795
C...CALLED     ZNORM, MAP.                                               VORLAX   2796
C...                                                                     VORLAX   2797
C...DISCUSSION THE DATA PRINTED OUT BY THIS SUBROUTINE ARE ARRANGED      VORLAX   2798
C...           IN THREE GROUPS, AS FOLLOWS:                              VORLAX   2799
C...           (1) INPUT DATA, THESE ARE DATA WHICH ARE TAKEN FROM       VORLAX   2800
C...               THE INPUT DECK AND HAVE BEEN CONVERTED IN A FORMAT    VORLAX   2801
C...               SUITABLE FOR USE BY THE PROGRAM.                      VORLAX   2802
C...           (2) PANEL AND TOTAL CONFIGURATION FORCE AND MOMENT        VORLAX   2803
C...               COEFFICIENT DATA.                                     VORLAX   2804
C...           (3) DATA WHICH ARE RELATED EITHER TO CHORDWISE STRIPS     VORLAX   2805
C...               OR TO INDIVIDUAL HORSESHOE VORTICES.                  VORLAX   2806
C...           THESE THREE DATA GROUPS ARE PRINTED SEQUENTIALLY.         VORLAX   2807
C...           IF A FLOW FIELD SURVEY HAS BEEN REQUESTED, THE CORRES     VORLAX   2808
C...           PONDING DATA ARE PRINTED OUT THROUGH SUBROUTINE MAP.      VORLAX   2809
C...                                                                     VORLAX   2810
C                                                                        VORLAX   2811
      DIMENSION EW (2000), EWX (2001), EWY (2001), EU (2001)             VORLAX   2812
      REAL MACH, NVOR, LIFT, MOMENT, LESWP                               VORLAX   2813
      INTEGER TITLE, CX, SX                                              VORLAX   2814
      COMMON LAX, LAY, IQ, IH, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,    VORLAX   2815
     *FLOATX, FLOATY, INVERS, ISOLV                                      VORLAX   2816
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                  VORLAX   2817
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                 VORLAX   2818
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)      VORLAX   2819
      COMMON /SET4 /DNDX1 (400), DNDX2 (400), AINC1 (20), AINC2 (20)     VORLAX   2820
      COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),        VORLAX   2821
     * LESWP (40), SYNTH (40), IQUANT (40), CSTART (40), TAPER (40),     VORLAX   2822
     * PSPAN (40), NVOR (40)                                             VORLAX   2823
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                  VORLAX   2824
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)        VORLAX   2825
      COMMON /SET8 /LIFT (40), DRAG (40), MOMENT (40), CL (40),        VORLAX   2826
     + CD (40), CM (40), FN (40), CN (40), FY (40), CY (40),           VORLAX   2827
     + RM (40), CRM (40), YM (40), CYM (40), XSUC (40), SUMF (40)      VORLAX   2828
      COMMON /SET9 /CDC (100), CNC (100)                               VORLAX   2829
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),      VORLAX   2830
     + TNT (100), XTE (100), IPAN (100)                                VORLAX   2831
      COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA    VORLAX   2832
      COMMON /SET12 /CLTOT, CDTOT, CMTOT, SREF, CYTOT, CRTOT, CNTOT    VORLAX   2833
      COMMON /SET13 /BIG, ITER, ITRMAX, EPS , NSPAN, RLN               VORLAX   2834
      COMMON /SET14 /NPAN, NT, SMAX , NPANAS                           VORLAX   2835
      COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                        VORLAX   2836
      COMMON /SET16 /GAMMA (2000), ONSET (2000)                        VORLAX   2837
      COMMON /SET17 /CSUC (100), CMTC (100), SPC (40)                  VORLAX   2838
      COMMON /SET18 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20) VORLAX  2839
      COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)       VORLAX   2840
      COMMON /SET20 /ZLE1 (20), ZLE2 (20), PHIMED (100), RCS (100),    VORLAX   2841
     + NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)           VORLAX   2842
C                                                                      VORLAX   2843
      PI = 3.14159                                                     VORLAX   2844
      DTR = 0.01745329                                                 VORLAX   2845
C                                                                      VORLAX   2846
C                                                                      VORLAX   2847
      IF (IQ .EQ. 1 .AND. IH .EQ. 1) GO TO 10                          VORLAX   2848
      WRITE (6, 350) TITLE                                             VORLAX   2849
      GO TO 110                                                        VORLAX   2850
C                                                                      VORLAX   2851
C...PRINTOUT FIRST DATA GROUP, I.E., INPUT DATA REARRANGED IN A FORMAT VORLAX   2852
C...SUITABLE FOR USE BY THE PROGRAM.                                   VORLAX   2853
C                                                                      VORLAX   2854
   10 WRITE (6, 20) TITLE                                              VORLAX   2855
   20 FORMAT (1H1, 20A4////1H , 14HPANEL GEOMETRY)                     VORLAX   2856
      WRITE (6, 30)                                                    VORLAX   2857
   30 FORMAT  (1H0, 44H I  XAPEX(I)  YAPEX(I)  ZAPEX(I)    PDL(I)  ,   VORLAX   2858
     + 56H LESWP(I) CSTART(I)  TAPER(I)  PSPAN(I)  NVOR(I)  RNCV(I),   VORLAX   2859
     + 9H   SPC(I)/)                                                   VORLAX   2860
      DO 50 I = 1, NPAN                                                VORLAX   2861
      WRITE (6, 40) I, XAPEX(I), YAPEX(I), ZAPEX(I), PDL(I), LESWP(I), VORLAX   2862
     + CSTART(I), TAPER(I), PSPAN(I), NVOR(I), RNCV(I), SPC(I)         VORLAX   2863
   40 FORMAT (1H , I2, 8F10.4, 2F8.0, F10.2)                           VORLAX   2864
   50 CONTINUE                                                         VORLAX   2865
      KED1 = 1                                                         VORLAX   2866
      DO 100 I = 1, NPAN                                               VORLAX   2867
      IF (SYNTH (I) .LT. 0.5) WRITE (6, 60) I                          VORLAX   2868
   60 FORMAT  (1H0, 43HINCIDENCE AND CAMBER SLOPE INPUT FOR PANEL ,I4) VORLAX   2869
      IF  (SYNTH  (I)  .GT. 0.5 ) WRITE  (6, 70 ) I                    VORLAX   2870
   70 FORMAT  (1H0 , 38HPRESSURE DISTRIBUTION INPUT FOR PANEL , I4)    VORLAX   2871
      MAX = RNCV (I)                                                   VORLAX   2872
      KED2 = KED1 + MAX - 1                                            VORLAX   2873
      WRITE (6, 80) AINC1 (I), AINC2 (I)                               VORLAX   2874
   80 FORMAT (1H0, 2F10.4)                                             VORLAX   2875
      WRITE (6, 90) (DNDX1 (J), J = KED1, KED2)                        VORLAX   2876
   90 FORMAT (1H , 10F10.4)                                            VORLAX   2877
      WRITE (6, 90) (DNDX2 (J), J = KED1, KED2)                        VORLAX   2878
      KED1 = KED1 + MAX                                                VORLAX   2879
  100 CONTINUE                                                         VORLAX   2880
C                                                                      VORLAX   2881
```

```
C...PRINTOUT PANEL AND TOTAL CONFIGURATION DATA (SECOND DATA GROUP).   VORLAX  2882
C                                                                      VORLAX  2883
      WRITE (6, 350) TITLE                                             VORLAX  2884
  110 WRITE (6, 120) MACH (IQ), ALPHA (IH), PSI, PITCHQ, ROLLQ, YAWQ   VORLAX  2885
  120 FORMAT (1H0,6HMACH =, F7.3 //1H ,7HALPHA =, F7.3,5H DEG./1H ,    VORLAX  2886
     * 5HPSI =,  F7.3,5H DEG.//1H ,12HPITCH RATE =, F7.2,              VORLAX  2887
     * 10H DEG /SEC /1H ,11HROLL RATE =, F7.2, 10H DEG /SEC  /1H ,     VORLAX  2888
     * 10HYAW RATE =, F7.2, 9H DEG /SEC ///)                           VORLAX  2889
      IF (INVERS  .EQ. 0) WRITE (6,130)                                VORLAX  2890
      IF (INVERS  .EQ. 1) WRITE (6,140)                                VORLAX  2891
  130 FORMAT (1H , 37HANALYSIS (DIRECT) CASE    (INVERS = 0)///)       VORLAX  2892
  140 FORMAT (1H , 37HDESIGN (INVERSE) CASE    (INVERS  = 1)///)       VORLAX  2893
      WRITE (6, 150) XBAR, ZBAR, VINF                                  VORLAX  2894
  150 FORMAT (1H , 39HMOMENT AND ROTATION CENTER  S   XBAR = , E12.5,  VORLAX  2895
     * 5X, 7HZBAR = , E12.5, 15H  ***** VINF = , E12.5)                VORLAX  2896
      IF (HAG .EQ. 0.) WRITE (6, 160)                                  VORLAX  2897
  160 FORMAT (1H0, 37HCONFIGURATION IS OUT OF GROUND EFFECT)           VORLAX  2898
      IF (HAG .GT. 0.) WRITE (6, 170) HAG                              VORLAX  2899
  170 FORMAT (1H0, 58HHEIGHT OF MOMENT REFERENCE CENTER ABOVE GROUND  S VORLAX  2900
     *  HAG =  , E10.4)                                                VORLAX  2901
      WRITE  (6, 180 ) FLOATX, FLOATY                                  VORLAX  2902
  180 FORMAT (/1H0, 45HVORTEX WAKE FLOATATION PARAMETERS S  FLOATX =,  VORLAX  2903
     * F5.2, 5X,  8HFLOATY =, F5.2)                                    VORLAX  2904
      WRITE (6, 190)                                                   VORLAX  2905
  190 FORMAT (/1H0/)                                                   VORLAX  2906
      WRITE (6, 200)                                                   VORLAX  2907
  200 FORMAT (1H , 39HCN REFERENCED TO SURF+  CL ,CY,CD,CT,CS ,        VORLAX  2908
     * 58HREFERENCED TO SREF+  CM REFERENCED TO SREF*CBAR+  CRM,CYM ,   VORLAX  2909
     * 24HREFERENCED TO SREF*WSPAN/)                                   VORLAX  2910
      WRITE  (6, 210 )                                                 VORLAX  2911
  210 FORMAT (1H ,7H   I    , 9HSURF/SREF, 7X, 5HCN(I), 7X, 5HCL(I),   VORLAX  2912
     * 7X, 5HCY(I), 7X, 5HCD(I), 7X, 5HCT(I), 7X, 5HCS(I), 10X,        VORLAX  2913
     * 5HCM(I), 7X, 6HCRM(I), 7X, 6HCYM(I) /)                          VORLAX  2914
  220 FORMAT (1H , I4, E12.4, 6F12.5, 2X, 3E13.4)                      VORLAX  2915
  230 FORMAT (1H , 2H**, I2, E12.4, 6F12.5, 2X, 3E13.4)                VORLAX  2916
      I = 1                                                            VORLAX  2917
      IX = 0                                                           VORLAX  2918
      ICYCLE = 1                                                       VORLAX  2919
  240 IX = IX + 1                                                      VORLAX  2920
      CS = XSUC (IX) *SQRT (1.0 + (TAN (DTR *LESWP (I))) **2)          VORLAX  2921
      F1 = SURF (IX) /SREF                                             VORLAX  2922
      F2 = CN (IX)                                                     VORLAX  2923
      F3 = CL  (IX) *F1                                                VORLAX  2924
      F4 = CY  (IX) *F1                                                VORLAX  2925
      F5 = CD  (IX) *F1                                                VORLAX  2926
      F6 = XSUC (IX) *F1                                               VORLAX  2927
      F7 = CS *F1                                                      VORLAX  2928
      F8 = CM (IX) *F1 /CBAR                                           VORLAX  2929
      F9 = CRM (IX) *F1 /WSPAN                                         VORLAX  2930
      F10 = CYM (IX) *F1 /WSPAN                                        VORLAX  2931
      IF (ICYCLE - 1) 250, 250, 260                                    VORLAX  2932
  250 WRITE (6, 220) I, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10        VORLAX  2933
      GO TO 270                                                        VORLAX  2934
  260 WRITE (6, 230) I, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10        VORLAX  2935
  270 IF (ICYCLE .EQ. 2) GO TO 290                                     VORLAX  2936
      I = I + 1                                                        VORLAX  2937
      IF (I - NPAN) 240, 240, 280                                      VORLAX  2938
  280 IF  (LATRAL  .EQ. 0 ) GO TO 300                                   VORLAX    2939
      ICYCLE = 2                                                        VORLAX    2940
      I = 0                                                             VORLAX    2941
  290 I = I + 1                                                         VORLAX    2942
      IF (I .GT. NPAN) GO TO 300                                        VORLAX    2943
      IF (IQUANT (I) .EQ. 1) GO TO 290                                  VORLAX    2944
      GO TO 240                                                         VORLAX    2945
  300 WRITE (6, 310)                                                    VORLAX    2946
  310 FORMAT(1H0,6X, 4HSREF, 9X, 5HWSPAN, 10X, 4HCBAR, 13X, 5HCLTOT,9X, VORLAX    2947
     * 5HCDTOT, 9X, 5HCYTOT, 5X, 5HCMTOT, 9X, 6HCRMTOT, 8X, 6HCYMTOT /) VORLAX    2948
  320 FORMAT (1H , 3E14.5, 3F14.5, 3E14.5 //)                           VORLAX    2949
      CMTOT = CMTOT /CBAR                                               VORLAX    2950
      CRTOT = CRTOT /WSPAN                                              VORLAX    2951
      CNTOT = CNTOT /WSPAN                                              VORLAX    2952
      WRITE (6, 320) SREF, WSPAN, CBAR, CLTOT, CDTOT, CYTOT, CMTOT,     VORLAX    2953
     * CRTOT, CNTOT                                                     VORLAX    2954
      IF (CLTOT .EQ. 0.) GO TO 340                                      VORLAX    2955
      CDCL = CDTOT /(CLTOT **2)                                         VORLAX    2956
      E = (SREF *CLTOT **2) /(WSPAN **2 *PI *CDTOT)                     VORLAX    2957
      WRITE (6, 330) CDCL, E                                            VORLAX    2958
  330 FORMAT (1H0, 10HCD/CL**2 =, F7.4, 4X, 3HE =, F7.4)                VORLAX    2959
C                                                                       VORLAX    2960
C                                                                       VORLAX    2961
C...PRINTOUT DATA PERTAINING TO THE CHORDWISE LATTICE STRIPS AND        VORLAX    2962
C...TO THE INDIVIDUAL HORSESHOE VORTICES (AERODYNAMIC LOAD DISTRIBUTION VORLAX    2963
C...DATA, THIRD DATA GROUP).                                            VORLAX    2964
C...                                                                    VORLAX    2965
C...INDEX LINE IS AN OUTPUT LINE COUNTER TO DETERMINE PAGE SWITCH       VORLAX    2966
C...CONTROL.                                                            VORLAX    2967
C...                                                                    VORLAX    2968
  340 LINE = 1                                                          VORLAX    2969
      DO 460 I = 1, ITOTAL                                              VORLAX    2970
      IF (LINE .EQ. 1) WRITE (6, 350) TITLE                             VORLAX    2971
  350 FORMAT (1H1, 20A4)                                                VORLAX    2972
      IF (LINE .EQ. 1) WRITE (6, 360) MACH (IQ), ALPHA (IM), PSI,       VORLAX    2973
     * PITCHQ, ROLLQ, YAWQ                                              VORLAX    2974
  360 FORMAT (1H0, 6HMACH =, F7.3, 4X, 7HALPHA =, F7.3, 3H DG, 4X,      VORLAX    2975
     * 5HPSI =, F7.3, 3H DG, 4X, 12HPITCH RATE =, F6.2, 4H D/S, 4X,     VORLAX    2976
     * 11HROLL RATE =, F6.2, 4H D/S, 4X, 10HYAW RATE =, F6.2, 4H D/S)   VORLAX    2977
      IF (LINE .EQ. 1) LINE = 3                                         VORLAX    2978
      IF (LINE .EQ. 3 .AND. INVERS .EQ. 0) WRITE (6, 420)               VORLAX    2979
      IF (LINE .EQ. 3 .AND. INVERS .EQ. 1) WRITE (6, 430)               VORLAX    2980
      IF (LINE .EQ. 3) LINE = 7                                         VORLAX    2981
      IS = SX (I)                                                       VORLAX    2982
      IC = CX (I)                                                       VORLAX    2983
      ILEX  = INVERS *IC                                                VORLAX    2984
C                                                                       VORLAX    2985
C...IF DESIGN PROCESS HAS BEEN INVOKED (INVERS = 1) THEN CALL           VORLAX    2986
C...SUBROUTINE ZNORM TO GENERATE THE CAMBERLINE THAT CORRESPONDS TO     VORLAX    2987
C...THE COMPUTED SLOPE DISTRIBUTION.                                    VORLAX    2988
C                                                                       VORLAX    2989
      IF (ILEX .EQ. 1) CALL ZNORM (I, IS, RNMAX (IS))                   VORLAX    2990
      R1V = IC                                                          VORLAX    2991
      R1 = .5 * (1. - COS ((R1V - .5) *PI /RNMAX (IS)))                 VORLAX    2992
      IF (LAX .EQ. 1) R1 = (R1V - 0.75) /RNMAX (IS)                     VORLAX    2993
      R2 = X (I)                                                        VORLAX    2994
      R3 = YY (I)                                                       VORLAX    2995
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            R4 = ZZ (I)                                              VORLAX   2996
            R5 = CHORD (IS)                                          VORLAX   2997
            R6 = SLOPE (I)                                           VORLAX   2998
            R7 = DCP (I)                                             VORLAX   2999
            R8  = CNC  (IS)                                          VORLAX   3000
            R9 = R8 /R5                                              VORLAX   3001
            R10 = DL (IS)                                            VORLAX   3002
            R11 = CMTC (IS) /R5                                      VORLAX   3003
            R12 = GAMMA (I)                                          VORLAX   3004
            IF (INVERS .EQ. 1) R12 = ZC (IC)                         VORLAX   3005
            R13 = CSUC  (IS) *R5                                     VORLAX   3006
            R14 = CDC (IS)                                           VORLAX   3007
            IF (IC .NE. 1) GO TO 400                                 VORLAX   3008
      C                                                              VORLAX   3009
            IF (IS .EQ. 1) GO TO 370                                 VORLAX   3010
            IF (IPAN (IS) .EQ. IPAN (IS - 1)) GO TO 390              VORLAX   3011
       370  IM1 = (IPAN (IS) - 1) *10 + 1                            VORLAX   3012
            IM2 = IM1 + 9                                            VORLAX   3013
            WRITE (6, 380) IPAN (IS), (HEAD (JJ), JJ = IM1, IM2)     VORLAX   3014
            LINE = LINE + 2                                          VORLAX   3015
       380  FORMAT (1H0, 30X, 9HPANEL NO., 2X, I2, 5X, 10A4)         VORLAX   3016
      C                                                              VORLAX   3017
       390  WRITE (6, 440) IS, IC, R1, R2, R3, R4, R5, R6, JTS (IS) , R7,  VORLAX   3018
           + R8, R9, R10 , R11, R12, R13, R14                        VORLAX   3019
            LINE = LINE + 1                                          VORLAX   3020
            GO TO 410                                                VORLAX   3021
       400  WRITE (6, 450) IS, IC, R1, R2, R3, R4, R5, R6, JTS (IS), R7, R12  VORLAX   3022
       410  LINE = LINE + 1                                          VORLAX   3023
            IF (LINE .GT. 57) LINE = 1                               VORLAX   3024
       420  FORMAT (1H0, 2X, 1HS, 2X, 1HC, 2X, 3HX/C, 6X, 1HX, 6X, 1HY,   VORLAX   3025
           + 8X, 1HZ, 5X, 5HCHORD, 3X, 5HSLOPE, 2X, 3HITS, 5X, 3HDCP, 6X,  VORLAX   3026
           + 3HCNC, 5X, 2HCN, 6X, 2HDL, 6X, 3HCMT, 8X, 5HGAMMA, 6X, 3HCTC,  VORLAX   3027
           + 6X, 3HCDC/1H0)                                          VORLAX   3028
       430  FORMAT (1H0, 2X, 1HS, 2X, 1HC, 2X, 3HX/C, 6X, 1HX, 6X, 1HY,   VORLAX   3029
           + 8X, 1HZ, 5X, 5HCHORD, 3X, 5HSLOPE, 2X, 3HITS, 5X, 3HDCP, 6X,  VORLAX   3030
           + 3HCNC, 5X, 2HCN, 6X, 2HDL, 6X, 3HCMT, 8X, 4HZC/C, 6X, 3HCTC,  VORLAX   3031
           + 6X, 3HCDC/1H0)                                          VORLAX   3032
       440  FORMAT (1H0, 2I3, F7.4, 3F8.3, 1X, F7.3, 1X, F7.4, I3, 1X, F8.3,  VORLAX   3033
           + F10.3, F7.3, F8.2, F10.4, E12.4, 2F9.5 )                VORLAX   3034
       450  FORMAT (1H , 2I3, F7.4, 3F8.3, 1X, F7.3, 1X, F7.4, I3, 1X, F8.3,  VORLAX   3035
           + 35X, E12.4)                                             VORLAX   3036
       460  CONTINUE                                                 VORLAX   3037
            IF (ISOLV .EQ. 1) GO TO 480                              VORLAX   3038
      C                                                              VORLAX   3039
      C...PRINTOUT RELAXATION SOLUTION PARAMETERS.                   VORLAX   3040
      C                                                              VORLAX   3041
            WRITE (6, 470) ITRMAX, EPS, ITER, BIG , RLM              VORLAX   3042
       470  FORMAT (1H0, 8HITRMAX =, I3/1H0, 5HEPS =, F10.5/1H0, 6HITER =,  VORLAX   3043
           + I3/1H0, 5HBIG =, F10.5/1H0, 20HCONVERGENCE FACTOR =, F10.5)  VORLAX   3044
      C                                                              VORLAX   3045
      C...IF FLOW FIELD SURVEY HAS BEEN REQUESTED (NXS > 0) THEN CALL  VORLAX   3046
      C...SUBROUTINE MAP TO COMPUTE AND PRINT THE FLOW QUANTITIES AT  VORLAX   3047
      C...THE NODAL POINTS OF THE SURVEY GRID.                       VORLAX   3048
      C                                                              VORLAX   3049
       480  IF  (NXS  .GT. 0) CALL MAP  (EW, EWX, EWY, ITOTAL)       VORLAX   3050
       490  WRITE (6, 500)                                           VORLAX   3051
       500  FORMAT (1H0, 11HEND OF CASE)                             VORLAX   3052
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                    RETURN                                                                   VORLAX    3053
                    END                                                                      VORLA     3054


      SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     3  PRINT

 VARIABLES      SN   TYPE              RELOCATION
   1440   AINC1      REAL        ARRAY      SET4            1464   AINC2       REAL        ARRAY      SET4
     20   ALFA       REAL                   SET11            334   ALOC        REAL        ARRAY      SET6
     10   ALPHA      REAL        ARRAY      SET11              1   BETA        REAL                   SET15
      0   BIG        REAL                   SET13              0   B2          REAL                   SET15
      2   CBAR       REAL                   SET15            240   CD          REAL        ARRAY      SET8
      0   CDC        REAL        ARRAY      SET9            1433   CDCL        REAL
      1   CDTOT      REAL                   SET12              0   CHORD       REAL        ARRAY      SET10
    170   CL         REAL        ARRAY      SET8               0   CLTOT       REAL                   SET12
    310   CM         REAL        ARRAY      SET8             144   CMTC        REAL        ARRAY      SET17
      2   CMTOT      REAL                   SET12            430   CN          REAL        ARRAY      SET8
    144   CNC        REAL        ARRAY      SET9               6   CNTOT       REAL                   SET12
    670   CRM        REAL        ARRAY      SET8               5   CRTOT       REAL                   SET12
   1420   CS         REAL                                    430   CSTARI      REAL        ARRAY      SET5
      0   CSUC       REAL        ARRAY      SET17              0   CX          INTEGER     ARRAY      SET13
    550   CY         REAL        ARRAY      SET8            1010   CYM         REAL        ARRAY      SET8
      4   CYTOT      REAL                   SET12              0   DCP         REAL        ARRAY      SET12
      4   DELTAY     REAL                   SET18              6   DELTAZ      REAL                   SET18
    144   DL         REAL        ARRAY      SET10              0   DNDX1       REAL        ARRAY      SET4
    620   DNDX2      REAL        ARRAY      SET4              50   DRAG        REAL        ARRAY      SET8
   1410   DTR        REAL                                   1434   E           REAL
      3   EPS        REAL                   SET13           1463   FU          REAL        *UNDEF
      0   EW         REAL        ARRAY       F.P.              0   FWX         REAL        ARRAY       F.P.
      0   EWY        REAL        ARRAY       F.P.             12   FLOATX      REAL                    / /
     13   FLOATY     REAL                    / /             360   FN          REAL        ARRAY      SET8
    500   FY         REAL        ARRAY      SET8            1421   F1          REAL
   1432   F10        REAL                                   1422   F2          REAL
   1423   F3         REAL                                   1424   F4          REAL
   1425   F5         REAL                                   1426   F6          REAL
   1427   F7         REAL                                   1430   F8          REAL
   1431   F9         REAL                                      0   GAMMA       REAL        ARRAY      SET16
     11   HAG        REAL                    / /              24   HEAD        REAL        ARRAY      SET6
   1411   I          INTEGER                                1437   IC          INTEGER
   1417   ICYCLE     INTEGER                               13560   IDES        INTEGER     ARRAY      SET3
      3   IM         INTEGER                 / /            1440   ILEX        INTEGER
   1460   IM1        INTEGER                                1461   IM2         INTEGER
    404   INTRAC     INTEGER     ARRAY      SET20             14   INVERS      INTEGER                 / /
   1130   IPAN       INTEGER     ARRAY      SET10              2   IQ          INTEGER                 / /
    360   IQUANT     INTEGER     ARRAY      SET5            1436   IS          INTEGER
     15   ISOLV      INTEGER                 / /               1   ITER        INTEGER                SET13
      0   ITOTAL     INTEGER                 F.P.              2   ITRMAX      INTEGER                SET13
    170   ITS        INTEGER     ARRAY      SET7            1416   IX          INTEGER
   1415   J          INTEGER                                1462   JJ          INTEGER
    214   JTS        INTEGER     ARRAY      SET7            1412   KED1        INTEGER
   1414   KED2       INTEGER                                   4   LATRAL      INTEGER                 / /
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      SUBROUTINE PRINT      74/74    OPT=1                          FTN 4.5+410A       10/04/76  10.15.13        PAGE        7

VARIABLES      SN  TYPE                RELOCATION
      0  LAX        INTEGER                / /              1  LAY        INTEGER                  / /
    240  LESWP      REAL        ARRAY     SET5              0  LIFT       REAL        ARRAY        SET8
   1435  LINE       INTEGER                                 0  MACH       REAL        ARRAY        SET11
   1413  MAX        INTEGER                               120  MOMENT     REAL        ARRAY        SET8
     23  NALPHA     INTEGER               SET11            22  NMACH      INTEGER                  SET11
      0  NPAN       INTEGER               SET14             3  NPANAS     INTEGER                  SET14
    360  NPP        INTEGER     ARRAY     SET20             1  NT         INTEGER                  SET14
    620  NVOR       REAL        ARRAY     SET5              0  NXS        INTEGER                  SET18
      1  NYS        INTEGER               SET18             2  NZS        INTEGER                  SET18
   3720  ONSET      REAL        ARRAY     SET16           170  PDL        REAL        ARRAY        SET5
     50  PHINED     REAL        ARRAY     SET20          1407  PI         REAL
      6  PITCHO     REAL                  / /               5  PSI        REAL                     / /
    550  PSPAN      REAL        ARRAY     SET5            214  RCS        REAL        ARRAY        SET20
   7640  RFLAG      REAL        ARRAY     SET13             5  RLM        REAL                     SET13
    620  RM         REAL        ARRAY     SET8              0  RNCV       REAL        ARRAY        SET7
     24  RNMAX      REAL        ARRAY     SET7              7  ROLLC      REAL                     / /
   1442  R1         REAL                                 1441  RIV        REAL
   1453  R10        REAL                                 1454  R11        REAL
   1455  R12        REAL                                 1456  R13        REAL
   1457  R14        REAL                                 1443  R2         REAL
   1444  R3         REAL                                 1445  R4         REAL
   1446  R5         REAL                                 1447  R6         REAL
   1450  R7         REAL                                 1451  R8         REAL
   1452  R9         REAL                                   50  SLE        REAL        ARRAY        SET19
      0  SLE1       REAL        ARRAY     SET19            24  SLE2       REAL        ARRAY        SET19
   3720  SLOPE      REAL        ARRAY     SET12             2  SMAX       REAL                     SET14
    310  SPC        REAL        ARRAY     SET17             3  SREF       REAL                     SET12
   1130  SURF       REAL        ARRAY     SET8           3720  SX         INTEGER     ARRAY        SET3
    310  SYNTH      REAL        ARRAY     SET5            500  TAPER      REAL        ARRAY        SET5
      0  TITLE      INTEGER     ARRAY     SET6            454  TNL        REAL        ARRAY        SET10
    620  TNT        REAL        ARRAY     SET10            21  VINF       REAL                     SET11
   7640  VSP        REAL        ARRAY     SET12           310  VSS        REAL        ARRAY        SET10
  10270  VST        REAL        ARRAY     SET20             4  WSPAN      REAL                     SET13
      0  X          REAL        ARRAY     SET1              0  XAPEX      REAL        ARRAY        SET5
      3  XBAR       REAL                  SET15             7  XS         REAL        ARRAY        SET18
   1060  XSUC       REAL        ARRAY     SET8            764  XTE        REAL        ARRAY        SET10
   3720  Y          REAL        ARRAY     SET1             50  YAPEX      REAL        ARRAY        SET5
     10  YAWO       REAL                  / /             740  Y4         REAL        ARRAY        SET8
      3  YNOT       REAL                  SET18           430  YY         REAL        ARRAY        SET20
   4044  Z          REAL        ARRAY     SET1            120  ZAPEX      REAL        ARRAY        SET5
      4  ZBAR       REAL                  SET15          4230  ZC         REAL        ARRAY        SET1
    214  ZETA       REAL        ARRAY     SET19             0  ZLE1       REAL        ARRAY        SET20
     24  ZLE2       REAL        ARRAY     SET20             5  ZNOT       REAL                     SET18
   4350  ZZ         REAL        ARRAY     SET20

FILE NAMES         MODE
        TAPE6      FMT

EXTERNALS             TYPE    ARGS
        COS        REAL        1 LIBRARY                         MAP                      4
        SQRT       REAL        1 LIBRARY                         TAN        REAL          1 LIBRARY
        ZNORM                  3

STATEMENT LABELS
     26  10                                504  20       FMT                         514  30       FMT
    551  40       FMT                        6  50                                   561  60       FMT
    574  70       FMT                      607  80       FMT                         616  90       FMT
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        SUBROUTINE PRINT        74/74    OPT=1                                    FTN 4.5+410        10/04/76  10.15.13        PAGE     8

STATEMENT LABELS
       0  100                                        130  110                                          642  120      FMT
     673  130       FMT                              701  140      FMT                                 715  150      FMT
     733  160       FMT                              745  170      FMT                                 763  180      FMT
     777  190       FMT                             1004  200      FMT                                1026  210      FMT
    1042  220       FMT                             1046  230      FMT                                 170  240
       0  250            INACTIVE                    223  260                                          225  270
       0  280            INACTIVE                    235  290                                          242  300
    1112  310       FMT                             1124  320      FMT                                1151  330      FMT
     262  340                                       1162  350      FMT                                1175  360      FMT
     403  370                                       1227  380      FMT                                 421  390
     430  400                                        435  410                                         1275  420      FMT
    1313  430       FMT                             1331  440      FMT                                1342  450      FMT
       0  460                                       1361  470      FMT                                 446  480
       0  490            INACTIVE                   1377  500      FMT

LOOPS   LABEL     INDEX      FROM-TO     LENGTH     PROPERTIES
   33   50      * I            94  98      27B                EXT REFS
   63   100     * I           100 113      43B                EXT REFS
  264   460     * I           203 270     157B                EXT REFS

COMMON BLOCKS    LENGTH
        / /         14
        SET1      2250
        SET2      6000
        SET3      8000
        SET4       840
        SET5       440
        SET6      2220
        SET7       240
        SET8       640
        SET9       200
        SET10      700
        SET11       20
        SET12        7
        SET13        6
        SET14        4
        SET15        5
        SET16     4000
        SET17      240
        SET18       27
        SET19      240
        SET20     6280

STATISTICS
  PROGRAM LENGTH                   5414B      2828
  CM LABELED COMMON LENGTH    [illegible]    12359
  CM BLANK COMMON LENGTH             16B        14
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```
      CONTROL*VRLX.SURVEY                                       9/17/76  VORLAX   3055
C...                                                                     VORLAX   3056
      SUBROUTINE SURVEY (EW, EWX, EWY, ITOTAL)                           VORLAX   3057
C...                                                                     VORLAX   3058
C...PURPOSE    TO GENERATE THREE AERODYNAMIC INFLUENCE COEFFICIENT       VORLAX   3059
C...           MATRICESS (1) THE UPWASH AT THE FLOW FIELD SURVEY         VORLAX   3060
C...           POINTS (EW / UNIT 3), (2) THE AXIALWASH AT THE FLOW       VORLAX   3061
C...           FIELD SURVEY POINTS (EWX / UNIT 4), AND (3) THE           VORLAX   3062
C...           SIDEWASH AT THE FLOW FIELD SURVEY POINTS (EWY / UNIT 7).  VORLAX   3063
C...           THESE MATRICES REPRESENT THE INDUCED VELOCITY FIELD       VORLAX   3064
C...           DUE TO THE HORSESHOE VORTICES OF THE LATTICE. THIS FLOW   VORLAX   3065
C...           FIELD IS MEASURED AT THE NODAL POINTS OF A SPECIFIED      VORLAX   3066
C...           3-D GRID.                                                 VORLAX   3067
C...                                                                     VORLAX   3068
C...INPUT      CALLING SEQUENCES                                         VORLAX   3069
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.              VORLAX   3070
C...           COMMONS                                                   VORLAX   3071
C...           X, B2, CX, DL, NT, SX, XS, YY, ZZ, MAG, LAX, NXS,         VORLAX   3072
C...           NYS, NZS, PSI, TNT, VSP, VST, ATE, ALFA, YNOT, XBAR,      VORLAX   3073
C...           ZBAR, ZNOT, CHORD, RNMAX, DELTAY, DELTAZ, FLOATX,         VORLAX   3074
C...           FLOATY, LATRAL.                                           VORLAX   3075
C...                                                                     VORLAX   3076
C...OUTPUT     CALLING SEQUENCES                                         VORLAX   3077
C...           EW = UPWASH MATRIX (STORED ROW BY ROW IN UNIT 3)          VORLAX   3078
C...           EWX = AXIALWASH MATRIX (STORED ROW BY ROW IN UNIT 4)      VORLAX   3079
C...           EWY = SIDEWASH MATRIX (STORED ROW BY ROW IN UNIT 7)       VORLAX   3080
C...           COMMONS                                                   VORLAX   3081
C...           NONE.                                                     VORLAX   3082
C...                                                                     VORLAX   3083
C...SUBROUTINES                                                          VORLAX   3084
C...CALLED     WASH, UXVEL.                                              VORLAX   3085
C...                                                                     VORLAX   3086
C...DISCUSSION THE ELEMENTS OF THE INFLUENCE COEFFICIENT MATRICES ARE    VORLAX   3087
C...           GENERATED BY COMPUTING THE VELOCITY INDUCED AT A FLOW     VORLAX   3088
C...           FIELD SURVEY POINT BY THE (K, J) HORSESHOE VORTEX OF      VORLAX   3089
C...           UNIT STRENGTH. IF THE FLOW FIELD SURVEY POINT IS          VORLAX   3090
C...           WITHIN A GIVEN NEAR FIELD RADIUS OF THE INDUCING          VORLAX   3091
C...           HORSESHOE VORTEX THEN THE AXIALWASH CONTRIBUTION IS       VORLAX   3092
C...           COMPUTED BY INTERDIGITATED VORTEX SPLITTING. THE FLOW     VORLAX   3093
C...           FIELD SURVEY POINTS ARE THE NODAL POINTS OF A 3-D GRID    VORLAX   3094
C...           DEFINED BY A SET OF THREE ORTHOGONAL PLANES. THESE        VORLAX   3095
C...           PLANES ARE SPECIFIED BY THE INPUT VALUES OF XS, YNOT,     VORLAX   3096
C...           DELTAY, ZNOT, AND DELTAZ.                                 VORLAX   3097
C...                                                                     VORLAX   3098
C...                                                                     VORLAX   3099
C...                                                                     VORLAX   3100
      DIMENSION EW (ITOTAL)                                              VORLAX   3101
      DIMENSION EWX (ITOTAL)                                             VORLAX   3102
      DIMENSION EWY (ITOTAL)                                             VORLAX   3103
      COMMON LAX, LAY, IQ, IM, LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, MAG,    VORLAX   3104
     * FLOATX, FLOATY                                                    VORLAX   3105
      COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                  VORLAX   3106
      COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                 VORLAX   3107
      COMMON /SET3 /CX (2000), SX (2000), RFLAG (2000), IDES (2000)      VORLAX   3108
      COMMON /SET7 /RNCV (20), RNMAX (100), ITS (20), JTS (100)          VORLAX   3109
      COMMON /SET10 /CHORD (100), DL (100), VSS (100), TNL (100),        VORLAX   3110
     * TNT (100), ATE (100), IPAN (100)                                  VORLAX   3111
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          COMMON /SET11 /MACH (8), ALPHA (8), ALFA, VINF, NMACH, NALPHA      VORLAX    3112
          COMMON /SET14 /NPAN, NT, SMAX , NPANAS                             VORLAX    3113
          COMMON /SET15 /B2, BETA, CBAR, XBAR, ZBAR                          VORLAX    3114
          COMMON /SET16 /NXS, NYS, NZS, YNOT, DELTAY, ZNOT, DELTAZ, XS (20)  VORLAX    3115
          COMMON /SET20 /ZLE1 (20), ZLE2 (20), PRIMED (100), RCS (100),      VORLAX    3116
         * NPP (20), INTRAC (20), YY (2000), ZZ(2000), VST(2000)             VORLAX    3117
          INTEGER CX, SX                                                     VORLAX    3118
    C                                                                        VORLAX    3119
          PI = 3.14159                                                       VORLAX    3120
          DTR = 0.01745329                                                   VORLAX    3121
    C                                                                        VORLAX    3122
    C                                                                        VORLAX    3123
          REWIND 3                                                           VORLAX    3124
          REWIND 4                                                           VORLAX    3125
          REWIND 7                                                           VORLAX    3126
    C                                                                        VORLAX    3127
    C                                                                        VORLAX    3128
          FLAX = LAX                                                         VORLAX    3129
    C                                                                        VORLAX    3130
    C...COMPUTE GEOMETRIC PARAMETERS RELATED TO WAKE FLOATATION.             VORLAX    3131
    C                                                                        VORLAX    3132
          FAL = FLOATA *ALFA                                                 VORLAX    3133
          FBL = FLOATY *PSI * DTR                                            VORLAX    3134
          NM = 0                                                             VORLAX    3135
          IF (FAL .NE. 0.0  .OR. FBL .NE. 0.0) NM = 1                        VORLAX    3136
    C                                                                        VORLAX    3137
    C...COMPUTE GEOMETRIC PARAMETERS RELATED TO GROUND EFFECT.               VORLAX    3138
    C                                                                        VORLAX    3139
          SI2A = SIN (2.0 *ALFA)                                             VORLAX    3140
          CO2A = COS (2.0 *ALFA)                                             VORLAX    3141
          HIN = HAG - ZBAR *COS (ALFA) + XBAR *SIN (ALFA)                    VORLAX    3142
          XIMO = 2.0 *HIN *SIN (ALFA)                                        VORLAX    3143
          ZIMO = - 2.0 *HIN *COS (ALFA)                                      VORLAX    3144
          TAN2A = SI2A /CO2A                                                 VORLAX    3145
    C                                                                        VORLAX    3146
    C...THERE ARE TWO MAJOR NESTED DO-LOOP SYSTEMS THAT GENERATE THE         VORLAX    3147
    C...COEFFICIENTS OF THE AERODYNAMIC INFLUENCE MATRICESS (1) LABEL 150    VORLAX    3148
    C...SYSTEM, AND (2) LABEL 140 SYSTEM. LABEL 140 LOOPS ARE INTERNAL TO    VORLAX    3149
    C...LABEL 150 LOOPS. THE LATTER ARE RELATED TO THE FLOW FIELD SURVEY     VORLAX    3150
    C...GRID POINTS, AND THE FORMER TO THE HORSESHOE VORTEX LATTICE. THE     VORLAX    3151
    C...VORTEX LATTICE IS COVERED STREAMWISE STRIP BY STREAMWISE STRIP.      VORLAX    3152
    C...THE SAME CODE LOGIC USED IN SUBROUTINE MATRIX IS APPLIED HERE.       VORLAX    3153
    C                                                                        VORLAX    3154
          DO 150 I = 1, NXS                                                  VORLAX    3155
    C     .                                                                  VORLAX    3156
    C...LOCATE CROSS-FLOW PLANE.                                             VORLAX    3157
    C                                                                        VORLAX    3158
          XCNTL = XS (I)                                                     VORLAX    3159
          DO 150 J1 = 1, NZS                                                 VORLAX    3160
    C.                                                                       VORLAX    3161
    C...LOCATE WATERLINE PLANE.                                              VORLAX    3162
    C                                                                        VORLAX    3163
          RJ1 = J1                                                           VORLAX    3164
          ZK1 = ZNOT + DELTAZ *(RJ1 - 1.)                                    VORLAX    3165
          DO 150 K1 = 1, NYS                                                 VORLAX    3166
    C                                                                        VORLAX    3167
    C...COMPUTE GRID POINT BUTT LINE.                                        VORLAX    3168
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C                                                                       VORLAX  3169
      RKI = KI                                                          VORLAX  3170
      YKI = YNOT + DELTAY *(RKI  - 1.)                                  VORLAX  3171
C                                                                       VORLAX  3172
C...COMPUTE HORSESHOE VORTEX INDUCTION WORKING STREAMWISE, STRIP BY     VORLAX  3173
C...STRIP, I.E., THE OUTER DO-LOOP RELATES TO A CHORDWISE STRIP, AND    VORLAX  3174
C...THE INNER DO-LOOP RELATES TO A HORSESHOE WITHIN THE STRIP (FROM     VORLAX  3175
C...LEADING EDGE TO TRAILING EDGE).                                     VORLAX  3176
C                                                                       VORLAX  3177
      IR = 0                                                            VORLAX  3178
      DO 140 K = 1, NT                                                  VORLAX  3179
C                                                                       VORLAX  3180
C...COMPUTE PARAMETERS COMMON TO A GIVEN STRIP.                         VORLAX  3181
C                                                                       VORLAX  3182
      PION2 = PI *.5 /RNMAX (K)                                         VORLAX  3183
      PION3 = 0.5 *PION2                                                VORLAX  3184
      PION4 = PION2 /8.0                                                VORLAX  3185
      DELX = CHORD (K) /RNMAX (K)                                       VORLAX  3186
      WEIGHT = 1.0                                                      VORLAX  3187
      WT1 = 0.25 *DELX                                                  VORLAX  3188
      CDL = COS (DTR* DL (K))                                           VORLAX  3189
      SDL = SIN (DTR * DL (K))                                          VORLAX  3190
      COS1 = COS (DTR * DL (K))                                         VORLAX  3191
      COS2 = COS1                                                       VORLAX  3192
      SIN1 = SIN (- DTR *DL (K))                                        VORLAX  3193
      SIN2 = - SIN1                                                     VORLAX  3194
      COSIN = COS (2.0 *DTR *DL (K))                                    VORLAX  3195
      SININ = SIN (2.0 *DTR *DL (K))                                    VORLAX  3196
      MAX2 = RNMAX (K)                                                  VORLAX  3197
C                                                                       VORLAX  3198
      AA = FAL *CDL - FBL *SDL                                          VORLAX  3199
      AM = FBL *CDL + FAL *SDL                                          VORLAX  3200
C                                                                       VORLAX  3201
 10   DO 140 J = 1, MAX2                                                VORLAX  3202
      IR = IR + 1                                                       VORLAX  3203
      XLOAD  = X (IR)                                                   VORLAX  3204
      X1 = XCNTL - XLOAD                                                VORLAX  3205
      YP = YK1 + YY(IR)                                                 VORLAX  3206
      YS = YK1 - YY (IR)                                                VORLAX  3207
      ZS = ZK1 - ZZ (IR)                                                VORLAX  3208
      Y1 = YS *CDL + ZS *SDL                                            VORLAX  3209
      Z1 = ZS *CDL - YS *SDL                                            VORLAX  3210
      Y2 = YP *CDL - ZS *SDL                                            VORLAX  3211
      Z2 = ZS *CDL + YP *SDL                                            VORLAX  3212
      RYZ1 = Y1 *Y1 + Z1 *Z1                                            VORLAX  3213
      RYZ2 = Y2 *Y2 + Z2 *Z2                                            VORLAX  3214
      X1SQ = X1 *X1                                                     VORLAX  3215
      RS1 = X1SQ - B2 *RYZ1                                             VORLAX  3216
      RS2 = X1SQ - B2 *RYZ2                                             VORLAX  3217
      IF (RS1 .GT. 0.0) RS1 = SQRT (RS1)                                VORLAX  3218
      IF (RS2 .GT. 0.0) RS2 = SQRT(RS2)                                 VORLAX  3219
      IF (LAX .EQ. 1) GO TO 20                                          VORLAX  3220
      RJ = 2 *J - 1                                                     VORLAX  3221
      RJ1 = 4 *J - 3                                                    VORLAX  3222
      DELX = 1.0                                                        VORLAX  3223
      WEIGHT = PION2 *SIN (RJ *PION2) *CHORD (K)                        VORLAX  3224
      WT1 = PION3 *SIN (RJ1 *PION3) *CHORD (K)                          VORLAX  3225
 20   XU1 = XLOAD - WT1                                                VORLAX   3226
      CT = XTE (K) - XLOAD                                             VORLAX   3227
      TESP = TNT (K)                                                   VORLAX   3228
      ESP = VSP (IR)                                                   VORLAX   3229
      VOSS = VST (IR)                                                  VORLAX   3230
      TOLZ = WEIGHT *DELX *1.0E-1                                      VORLAX   3231
C                                                                      VORLAX   3232
C...IF FIELD POINT IS WITHIN A GIVEN NEAR FIELD RADIUS (RNF) OF        VORLAX   3233
C...HORSESHOE THEN COMPUTE AXIALWASH (U1) BY INTERDIGITATED VORTEX     VORLAX   3234
C...SPLITTING.                                                         VORLAX   3235
C                                                                      VORLAX   3236
      UVEL = 0.0                                                       VORLAX   3237
      IDIT = 0                                                         VORLAX   3238
      RNF = 4.0 *WEIGHT *DELX                                          VORLAX   3239
      IF (RS1 .LE. 0.0) GO TO 60                                       VORLAX   3240
      IF (RS1 .GT. RNF) GO TO 60                                       VORLAX   3241
      RJM = J - 1                                                      VORLAX   3242
      COSM = COS (2.0 *PION2 *RJM)                                     VORLAX   3243
      DO 50 L = 1, 8                                                   VORLAX   3244
      IF (LAX .EQ. 0) GO TO 30                                         VORLAX   3245
      RVL = 4 *L - 3                                                   VORLAX   3246
      XDIF = RVL *DELX /32.0                                           VORLAX   3247
      WFR = 0.1250                                                     VORLAX   3248
      GO TO 40                                                         VORLAX   3249
 30   RVL = 16 *(J - 1) + 2 *L - 1                                     VORLAX   3250
      XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                 VORLAX   3251
      WFR = PION4 *SIN (PION4 *RVL)                                    VORLAX   3252
 40   XINT = XCNTL - XU1 - XDIF                                        VORLAX   3253
      CALL UXVEL (XINT, Y1, Z1, VOSS, ESP, B2, TOLZ, UDV)              VORLAX   3254
      UVEL = UVEL + UDV *WFR                                           VORLAX   3255
 50   CONTINUE                                                         VORLAX   3256
      DCW = 1.0                                                        VORLAX   3257
      IF (LAX .EQ. 0)  DCW = CHORD (K) /WEIGHT                         VORLAX   3258
      UVEL = UVEL * DCW                                                VORLAX   3259
      IDIT = 1                                                         VORLAX   3260
C                                                                      VORLAX   3261
C...SUBROUTINE WASH COMPUTES THE VELOCITY COMPONENTS INDUCED BY A      VORLAX   3262
C...GENERALIZED HORSESHOE VORTEX OF UNIT STRNGTH.                      VORLAX   3263
C                                                                      VORLAX   3264
 60   CALL WASH (X1,Y1,Z1,VOSS,ESP,B2,U1,V1,W1,AA,AM,TESP,CT,MM)       VORLAX   3265
      IF (IDIT .EQ. 1) U1 = UVEL                                       VORLAX   3266
C                                                                      VORLAX   3267
C...IF CONFIGURATION IS IN GROUND EFFECT (HAG . 0.) THEN COMPUTE THE   VORLAX   3268
C...INDUCTION DUE TO IMAGE OF HORSESHOE MIRRORED ABOUT GROUND PLANE.   VORLAX   3269
C                                                                      VORLAX   3270
      IF (HAG .EQ. 0.0) GO TO 70                                       VORLAX   3271
      XIM = XIMO + X (IR) *CO2A + ZZ (IR) *SI2A                        VORLAX   3272
      ZIM = ZIMO + X (IR) *SI2A - ZZ (IR) *CO2A                        VORLAX   3273
      X1I = XCNTL - XIM                                                VORLAX   3274
      ZSI = ZK1 - ZIM - X1I *TAN2A                                     VORLAX   3275
      Y1I = YS *CDL - ZSI *SDL                                         VORLAX   3276
      Z1I = ZSI *CDL + YS *SDL                                         VORLAX   3277
      CALL WASH (X1I,Y1I,Z1I,VOSS,ESP,B2,U1I,V1I,W1I,AA,AM,TESP,CT,MM) VORLAX   3278
      U1 = U1 - U1I                                                    VORLAX   3279
      V1 = V1 - V1I *COSIM - W1I *SINIM                                VORLAX   3280
      W1 = W1 + V1I *SINIM - W1I *COSIM                                VORLAX   3281
 70   IF (LATRAL .EQ. 1) GO TO 130                                     VORLAX   3282
```

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C                                                                       VORLAX    3283
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL THEN           VORLAX    3284
C...COMPUTE INFLUENCE OF IMAGE OF HORSESHOE MIRRORED ABOUT PLANE OF      VORLAX    3285
C...SYMMETRY, I.E., X-Z PLANE.                                           VORLAX    3286
C                                                                       VORLAX    3287
C                                                                       VORLAX    3288
      UVEL = 0.0                                                        VORLAX    3289
      IDIT = 0                                                          VORLAX    3290
      IF (RS2 .LE. 0.0) GO TO 110                                       VORLAX    3291
      IF (RS2 .GT. RNF) GO TO 110                                       VORLAX    3292
      RJM = J - 1                                                       VORLAX    3293
      COSM = COS (2.0 *PION2 *RJM)                                      VORLAX    3294
      DO 100 L = 1, 8                                                   VORLAX    3295
      IF (LAX .EQ. 0) GO TO 80                                          VORLAX    3296
      RVL = 4 *L - 3                                                    VORLAX    3297
      XDIF = RVL *DELX /32.0                                            VORLAX    3298
      WFR = 0.1250                                                      VORLAX    3299
      GO TO 90                                                          VORLAX    3300
   80 RVL = 16 *(J - 1) + 2 *L - 1                                      VORLAX    3301
      XDIF = 0.5 *(COSM - COS (PION4 *RVL)) *CHORD (K)                  VORLAX    3302
      WFR = PION4 *SIN (PION4 *RVL)                                     VORLAX    3303
   90 XINT = XCNTL - XU1 - XDIF                                         VORLAX    3304
      CALL UXVEL (XINT, Y2, Z2, VOSS, -ESP, B2, TOLZ, UDV)              VORLAX    3305
      UVEL = UVEL + UDV *WFR                                            VORLAX    3306
  100 CONTINUE                                                          VORLAX    3307
      DCW = 1.0                                                         VORLAX    3308
      IF (LAX .EQ. 0) DCW = CHORD (K) /WEIGHT                           VORLAX    3309
      UVEL = UVEL *DCW                                                  VORLAX    3310
      IDIT = 1                                                          VORLAX    3311
C                                                                       VORLAX    3312
  110 CALL WASH (X1,Y2,Z2,VOSS, - ESP,B2,U2,V2,W2,AA,AM, -TESP,CT,MM)    VORLAX    3313
      IF (IDIT .EQ. 1) U2 = UVEL                                        VORLAX    3314
C                                                                       VORLAX    3315
C...IF CONFIGURATION AND FLIGHT CONDITION ARE SYMMETRICAL, AND           VORLAX    3316
C...CONFIGURATION IS IN GROUND EFFECT, THEN COMPUTE INFLUENCE OF         VORLAX    3317
C...IMAGE OF HORSESHOE MIRRORED ABOUT CENTER PLANE (X-Z PLANE) AND       VORLAX    3318
C...MIRRORED ONCE MORE ABOUT GROUND PLANE.                               VORLAX    3319
C                                                                       VORLAX    3320
      IF (MAG  .EQ. 0.0) GO TO 120                                      VORLAX    3321
      Y2I = YP *CDL + ZSI *SDL                                          VORLAX    3322
      Z2I = ZSI *CDL - YP *SDL                                          VORLAX    3323
      CALL WASH(X1I,Y2I,Z2I,VOSS,-ESP,B2,U2I,V2I,W2I,AA,AM,-TESP,CT,MM) VORLAX    3324
      U2 = U2 - U2I                                                     VORLAX    3325
      V2 = V2 - V2I *COSIM + W2I *SINIM                                 VORLAX    3326
      W2 = W2 - V2I *SINIM - W2I *COSIM                                 VORLAX    3327
C                                                                       VORLAX    3328
  120 EW (IR) = (W1 *COS1 + W2 *COS2 - V1 *SIN1 - V2 *SIN2) *WEIGHT     VORLAX    3329
      EWY (IR) = (V1 *COS1 + V2 *COS2 - W1 *SIN1 - W2 *SIN2) *WEIGHT    VORLAX    3330
      EWX (IR) = (U1 + U2) *WEIGHT                                      VORLAX    3331
      GO TO 140                                                         VORLAX    3332
C                                                                       VORLAX    3333
  130 EW (IR) = (W1 *COS1 - V1 *SIN1) *WEIGHT                           VORLAX    3334
      EWY (IR) = (V1 *COS1 - W2 *SIN2) *WEIGHT                          VORLAX    3335
      EWX (IR) = U1 *WEIGHT                                             VORLAX    3336
  140 CONTINUE                                                          VORLAX    3337
C                                                                       VORLAX    3338
C                                                                       VORLAX    3339
```

```
                       WRITE (3) EW                                                                 VORLAX    3340
                       WRITE (4) EWX                                                                VORLAX    3341
                       WRITE (7) EWY                                                                VORLAX    3342
                 C                                                                                  VORLAX    3343
                 C                                                                                  VORLAX    3344
                  150  CONTINUE                                                                     VORLAX    3345
                 C                                                                                  VORLAX    3346
                 C                                                                                  VORLAX    3347
                       REWIND 3                                                                     VORLAX    3348
                       REWIND 4                                                                     VORLAX    3349
                       REWIND 7                                                                     VORLAX    3350
                 C                                                                                  VORLAX    3351
                 C                                                                                  VORLAX    3352
                       RETURN                                                                       VORLAX    3353
                       END                                                                          VORLAX    3354


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  SURVEY

VARIABLES      SN  TYPE           RELOCATION
  1026  AA         REAL                                      20  ALFA      REAL                SET11
    10  ALPHA      REAL       ARRAY     SET11              1027  AM        REAL
     1  BETA       REAL                 SET15                 0  B2        REAL                SET15
     2  CBAR       REAL                 SET15              1015  CDL       REAL
     0  CHORD      REAL       ARRAY     SET10              1023  COSIM     REAL
  1062  COSM       REAL                                    1017  COS1      REAL
  1020  COS2       REAL                                     770  CO2A      REAL
  1051  CT         REAL                                       0  CX        INTEGER   ARRAY     SET3
     0  DCP        REAL       ARRAY     SET2               1071  DCW       REAL
     4  DELTAY     REAL                 SET18                 6  DELTAZ    REAL                SET18
  1012  DELX       REAL                                     144  DL        REAL      ARRAY     SET10
   762  DTR        REAL                                    1053  ESP       REAL
     0  EW         REAL       ARRAY      F.P.                 0  EWX       REAL      ARRAY      F.P.
     0  EWY        REAL       ARRAY      F.P.               764  FAL       REAL
   765  FBL        REAL                                     763  FLAX      REAL
    12  FLOATX     REAL                 / /                  13  FLOATY    REAL                / /
    11  MAG        REAL                 / /                 771  HIM       REAL
   775  I          INTEGER                                13560  IDES      INTEGER   ARRAY     SET3
  1057  IDIT       INTEGER                                    3  IH        INTEGER             / /
   404  INTRAC     INTEGER    ARRAY     SET20              1130  IPAN      INTEGER   ARRAY     SET10
     2  IQ         INTEGER              / /                1005  IR        INTEGER
     0  ITOTAL     INTEGER               F.P.               170  ITS       INTEGER   ARRAY     SET7
  1030  J          INTEGER                                  214  JTS       INTEGER   ARRAY     SET7
   777  J1         INTEGER                                 1006  K         INTEGER
  1002  K1         INTEGER                                 1063  L         INTEGER
     4  LATRAL     INTEGER              / /                   0  LAX       INTEGER             / /
     1  LAY        INTEGER              / /                   0  MACH      INTEGER   ARRAY     SET11
  1025  MAX2       INTEGER                                  766  MM        INTEGER
    23  NALPHA     INTEGER              SET11                22  NMACH     INTEGER             SET11
     0  NPAN       INTEGER              SET14                 3  NPANAS    INTEGER             SET14
   360  NPP        INTEGER    ARRAY     SET20                 1  NT        INTEGER             SET14
```

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        SUBROUTINE SURVEY      74/74    OPT=1                         FTN 4.5+410A        10/04/76  10.15.13        PAGE      7

  VARIABLES       SN   TYPE              RELOCATION
        0  NXS         INTEGER                SET18           1   NYS       INTEGER               SET18
        2  NZS         INTEGER                SET18          50   PHIMED    REAL        ARRAY     SET20
      761  PI          REAL                                1007   PION2     REAL
     1010  PION3       REAL                                1011   PION4     REAL
        6  PITCHO      REAL                   / /             5   PSI       REAL                  / /
      214  RCS         REAL        ARRAY      SET20        7640   RFLAG     REAL        ARRAY     SET3
     1047  RJ          REAL                                1061   RJM       REAL
     1000  RJ1         REAL                                1003   RK1       REAL
        0  RNCV        REAL        ARRAY      SET7         1060   RNF       REAL
       24  RNMAX       REAL        ARRAY      SET7            7   ROLLO     REAL                  / /
     1045  RS1         REAL                                1046   RS2       REAL
     1064  RVL         REAL                                1042   RYZ1      REAL
     1043  RYZ2        REAL                                1016   SOL       REAL
     1024  SININ       REAL                                1021   SIN1      REAL
     1022  SIN2        REAL                                 767   S12A      REAL
     3720  SLOPE       REAL        ARRAY      SET2            2   SMAX      REAL                  SET14
     3720  SX          INTEGER     ARRAY      SET3          774   TAN2A     REAL
     1052  TESP        REAL                                 454   TNL       REAL        ARRAY     SET10
      620  TNT         REAL        ARRAY      SET10        1055   TOLZ      REAL
     1070  UDV         REAL                                1056   UVEL      REAL
     1072  U1          REAL                                1103   U1I       REAL
     1106  U2          REAL                                1113   U2I       REAL
       21  VINF        REAL                   SET11        1054   VOSS      REAL
     7640  VSP         REAL        ARRAY      SET2          310   VSS       REAL        ARRAY     SET10
    10270  VST         REAL        ARRAY      SET20        1073   V1        REAL
     1104  V1I         REAL                                1107   V2        REAL
     1114  V2I         REAL                                1013   WEIGHT    REAL
     1066  WFK         REAL                                1014   WT1       REAL
     1074  W1          REAL                                1105   W1I       REAL
     1110  W2          REAL                                1115   W2I       REAL
        0  X           REAL        ARRAY      SET1            3   XBAR      REAL                  SET15
      776  XCNTL       REAL                                1065   XDIF      REAL
     1075  XIM         REAL                                 772   XIMO      REAL
     1067  XINT        REAL                                1031   XLOAC     REAL
        7  XS          REAL        ARRAY      SET18         764   XTE       REAL        ARRAY     SET10
     1050  XU1         REAL                                1032   X1        REAL
     1077  X1I         REAL                                1044   X1SQ      REAL
     3720  Y           REAL        ARRAY      SET1           10   YAWO      REAL                  / /
     1004  YP1         REAL                                   3   YNOT      REAL                  SET18
     1033  YP          REAL                                1034   YS        REAL
      430  YY          REAL        ARRAY      SET20        1036   Y1        REAL
     1101  Y1I         REAL                                1040   Y2        REAL
     1111  Y2I         REAL                                4044   Z         REAL        ARRAY     SET1
        4  ZBAR        REAL                   SET15        4230   ZC        REAL        ARRAY     SET1
     1076  ZIM         REAL                                 773   ZIMO      REAL
     1001  ZK1         REAL                                   0   ZLE1      REAL        ARRAY     SET20
       24  ZLE2        REAL        ARRAY      SET20           5   ZNOT      REAL                  SET18
     1035  ZS          REAL                                1100   ZS1       REAL
     4350  ZZ          REAL        ARRAY      SET20        1037   Z1        REAL
     1102  Z1I         REAL                                1041   Z2        REAL
     1112  Z2I         REAL

 FILE NAMES          MODE
        TAPE3        UNFMT                     TAPE4       UNFMT                    TAPE7       UNFMT
      SUBROUTINE SURVEY      74/74    OPT=1                                  FTN 4.5+410A        10/04/76  10.15.13        PAGE       8

EXTERNALS           TYPE    ARGS
        COS         REAL       1 LIBRARY                                  SIN        REAL          1 LIBRARY
        SQRT        REAL       1 LIBRARY                                  UXVEL                    8
        WASH                  14

STATEMENT LABELS
     0  10           INACTIVE                  233   20                                    272   30
   307  40                                       0   50                                    331   60
   374  70                                     420   80                                    435   90
     0  100                                    460   110                                   514   120
   533  130                                    544   140                                     0   150

LOOPS  LABEL     INDEX        FROM-TO     LENGTH     PROPERTIES
   65  150     • I            101 291      513B                       EXT REFS  NOT INNER
   70  150     • J1           106 291      505B                       EXT REFS  NOT INNER
   76  150     • K1           112 291      475B                       EXT REFS  NOT INNER
  105  140     • K            125 283      444B                       EXT REFS  NOT INNER
  153  140     • J            148 283      374B                       EXT REFS  NOT INNER
  262  50      • L            190 202       37B                       EXT REFS
  410  100     • L            241 253       40B                       EXT REFS

COMMON BLOCKS   LENGTH
       / /           12
       SET1        2250
       SET2        6000
       SET3        8000
       SET7         240
       SET10        700
       SET11         20
       SET14          4
       SET15          5
       SET18         27
       SET20       6280

STATISTICS
   PROGRAM LENGTH                 1136B      606
   CM LABELED COMMON LENGTH      55746B    23526
   CM BLANK COMMON LENGTH           14B       12
```

```
      CONTROL*VRLX.UXVEL                                        9/14/76  VORLAX  3355
C...                                                                     VORLAX  3356
      SUBROUTINE UXVEL (X, Y, Z, S, T, B2, TOLZ, U)                      VORLAX  3357
C...                                                                     VORLAX  3358
C...PURPOSE    TO COMPUTE THE AXIALWASH INDUCED BY A SKEWED              VORLAX  3359
C...           RECTILINEAR VORTEX SEGMENT OF UNIT CIRCULATION.           VORLAX  3360
C...                                                                     VORLAX  3361
C...INPUT      CALLING SEQUENCES                                         VORLAX  3362
C...           X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF             VORLAX  3363
C...                     RECEIVING POINT MEASURED IN A REFERENCE FRAME   VORLAX  3364
C...                     CENTERED AT THE MIDPOINT OF VORTEX SEGMENT,     VORLAX  3365
C...                     THE X-AXIS IS PARALLEL TO THE X-AXIS OF THE     VORLAX  3366
C...                     MASTER (CONFIGURATION) COORDINATE SYSTEM, THE   VORLAX  3367
C...                     Y-AXIS IS NORMAL TO THE X-AXIS BUT LIES IN      VORLAX  3368
C...                     THE PLANE DETERMINED BY THE X-AXIS AND THE      VORLAX  3369
C...                     VORTEX SEGMENT, AND THE Z-AXIS IS NORMAL TO     VORLAX  3370
C...                     SUCH PLANE.                                     VORLAX  3371
C...           S = SEMISPAN OF VORTEX SEGMENT.                           VORLAX  3372
C...           T = TANGENT OF SWEEP ANGLE OF VORTEX SEGMENT.             VORLAX  3373
C...           B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).           VORLAX  3374
C...           TOLZ = NUMERICAL TOLERANCE CONSTANT.                      VORLAX  3375
C...           COMMONS                                                   VORLAX  3376
C...           NONE.                                                     VORLAX  3377
C...                                                                     VORLAX  3378
C...OUTPUT     CALLING SEQUENCES                                         VORLAX  3379
C...           U = X-AXIS VELOCITY COMPONENT (AXIALWASH) INDUCED BY      VORLAX  3380
C...               SKEWED VORTEX SEGMENT OF UNIT INTENSITY.              VORLAX  3381
C...           COMMONS                                                   VORLAX  3382
C...           NONE.                                                     VORLAX  3383
C...                                                                     VORLAX  3384
C...SUBROUTINES                                                          VORLAX  3385
C...CALLED     NONE.                                                     VORLAX  3386
C...                                                                     VORLAX  3387
C...DISCUSSION THIS SUBROUTINE IS CALLED WHEN THE AXIALWASH IS           VORLAX  3388
C...           COMPUTED IN ACCORDANCE WITH VORTEX SPLITTING SCHEME.      VORLAX  3389
C...           ONLY THE AXIALWASH IS COMPUTED, AND ONLY THE TRANS        VORLAX  3390
C...           VERSE SEGMENT OF THE HORSESHOE IS TAKEN INTO ACCOUNT.     VORLAX  3391
C...           THE SAME COMMENTS PRESENTED IN SUBROUTINE WASH            VORLAX  3392
C...           REGARDING THE NUMERICAL SINGULARITY IN THE VICINITY       VORLAX  3393
C...           OF THE CHARACTERISTIC SURFACES (MACH CONES) ARE           VORLAX  3394
C...           ALSO APPLICABLE HERE. SUBROUTINE UXVEL IS A DIRECT        VORLAX  3395
C...           COPY OF PARTS OF SUBROUTINE WASH.                         VORLAX  3396
C...                                                                     VORLAX  3397
C...                                                                     VORLAX  3398
C                                                                        VORLAX  3399
      CUTOFF = 0.80                                                      VORLAX  3400
      X1 = X + T*S                                                       VORLAX  3401
      Y1 = Y + S                                                         VORLAX  3402
      X2 = X - T*S                                                       VORLAX  3403
      Y2  = Y  - S                                                       VORLAX  3404
      XTY = X - T *Y                                                     VORLAX  3405
      U = 0.                                                             VORLAX  3406
      TOL = TOLZ                                                         VORLAX  3407
      TOLSQ  = TOL *TOL                                                  VORLAX  3408
      ZSQ  = Z *Z                                                        VORLAX  3409
      BZQ  = B2 *ZSQ                                                     VORLAX  3410
      IF (ABS (BZQ) .LT. TOLSQ) GO TO 90                                 VORLAX  3411
      YSQ1 = Y1 *Y1                                                     VORLAX  3412
      YSQ2 = Y2 *Y2                                                     VORLAX  3413
      RTV1 = YSQ1 + ZSQ                                                 VORLAX  3414
      RTV2 = YSQ2 + ZSQ                                                 VORLAX  3415
      RO1 = B2 *RTV1                                                    VORLAX  3416
      RO2 = B2 *RTV2                                                    VORLAX  3417
      RAD1 = 0.0                                                        VORLAX  3418
      RAD2 = 0.0                                                        VORLAX  3419
      XSQ1 = X1 *X1                                                     VORLAX  3420
      XSQ2 = X2 *X2                                                     VORLAX  3421
      IF (B2) 10, 40, 40                                                VORLAX  3422
C                                                                       VORLAX  3423
C                                                                       VORLAX  3424
C...SUBSONIC FLOW COMPUTATION.                                          VORLAX  3425
C                                                                       VORLAX  3426
C                                                                       VORLAX  3427
   10 CPI = 12.56636                                                    VORLAX  3428
      ARG = XSQ1 - RO1                                                  VORLAX  3429
      RAD1 = SQRT (ARG)                                                 VORLAX  3430
      ARG = XSQ2 - RO2                                                  VORLAX  3431
      RAD2 = SQRT (ARG)                                                 VORLAX  3432
      FB1 = 0.0                                                         VORLAX  3433
      FB2 = 0.0                                                         VORLAX  3434
      XBSQ = XTY *XTY                                                   VORLAX  3435
      TBZ = (T *T - B2) *ZSQ                                            VORLAX  3436
      DENOM = XBSQ + TBZ                                                VORLAX  3437
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = TOLSQ                         VORLAX  3438
      FB1 = (T *X1 - B2 *Y1) /RAD1                                      VORLAX  3439
   20 FB2 = (T *X2 - B2 *Y2) /RAD2                                      VORLAX  3440
   30 QB = (FB1 - FB2) /DENOM                                           VORLAX  3441
      ZETAPI = Z /CPI                                                   VORLAX  3442
      U = ZETAPI *QB                                                    VORLAX  3443
      GO TO 90                                                          VORLAX  3444
C                                                                       VORLAX  3445
C                                                                       VORLAX  3446
C...SUPERSONIC FLOW COMPUTATION.                                        VORLAX  3447
C                                                                       VORLAX  3448
C                                                                       VORLAX  3449
   40 CPI = 6.28318                                                     VORLAX  3450
      IF (X1 .LT. TOL) GO TO 50                                         VORLAX  3451
      ARG = XSQ1 - RO1                                                  VORLAX  3452
      IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)                               VORLAX  3453
   50 IF (X2 .LT. TOL) GO TO 60                                         VORLAX  3454
      ARG = XSQ2 - RO2                                                  VORLAX  3455
      IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)                               VORLAX  3456
   60 ZETAPI = Z /CPI                                                   VORLAX  3457
      FB1 = 0.0                                                         VORLAX  3458
      FB2 = 0.0                                                         VORLAX  3459
      XBSQ = XTY *XTY                                                   VORLAX  3460
      TBZ = (T *T - B2) *ZSQ                                            VORLAX  3461
      DENOM = XBSQ + TBZ                                                VORLAX  3462
      SIGN = 1.0                                                        VORLAX  3463
      IF (DENOM .LT. 0.0) SIGN = - 1.0                                  VORLAX  3464
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = SIGN *TOLSQ                   VORLAX  3465
      IF (X1 .LT. TOL) GO TO 70                                         VORLAX  3466
      IF (RAD1 .EQ. 0.0) GO TO 70                                       VORLAX  3467
```

```
 115             FRAD = RAD1                                             VORLAX    3469
                 IF (RO1 .GT. REPS) GO TO 70                             VORLAX    3470
                 FB1 = (T *X1 - B2 *Y1) /FRAD                            VORLAX    3471
            70   IF (X2 .LT. TOL) GO TO 80                               VORLAX    3472
                 IF (RAD2 .EQ. 0.0) GO TO 80                             VORLAX    3473
 120             REPS = CUTOFF *XSQ2                                     VORLAX    3474
                 FRAD = RAD2                                             VORLAX    3475
                 IF (RO2 .GT. REPS) GO TO 80                             VORLAX    3476
                 FB2 = (T *X2 - B2 *Y2) /FRAD                            VORLAX    3477
            80   QB = (FB1 - FB2) /DENOM                                 VORLAX    3478
 125             U = ZETAPI *QB                                          VORLAX    3479
           C                                                             VORLAX    3480
           C                                                             VORLAX    3481
            90   RETURN                                                  VORLAX    3482
                 END                                                     VORLAX    3483
```

```
     SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  UXVEL

VARIABLES      SN  TYPE              RELOCATION
   235  ARG        REAL                              221  AZQ       REAL
     0  B2         REAL                 F.P.         234  CPI       REAL
   210  CUTOFF     REAL                              242  DENOM     REAL
   236  FB1        REAL                              237  FB2       REAL
   247  FRAD       REAL                              243  QB        REAL
   230  RAD1       REAL                              231  RAD2      REAL
   246  REPS       REAL                              226  RO1       REAL
   227  RO2        REAL                              224  RTV1      REAL
   225  RTV2       REAL                                0  S         REAL           F.P.
   245  SIGN       REAL                                0  T         REAL           F.P.
   241  TBZ        REAL                              216  TOL       REAL
   217  TOLSQ      REAL                                0  TOLZ      REAL           F.P.
     0  U          REAL                 F.P.           0  X         REAL           F.P.
   240  XBSQ       REAL                              232  XSQ1      REAL
   233  XSQ2       REAL                              215  XTY       REAL
   211  X1         REAL                              213  X2        REAL
     0  Y          REAL                 F.P.         222  YSQ1      REAL
   223  YSQ2       REAL                              212  Y1        REAL
   214  Y2         REAL                                0  Z         REAL           F.P.
   244  ZETAPI     REAL                              220  ZSQ       REAL

EXTERNALS           TYPE    ARGS
       SQRT         REAL       1 LIBRARY

INLINE FUNCTIONS    TYPE    ARGS
       ABS          REAL       1  INTRIN

STATEMENT LABELS
     0  10          INACTIVE             0  20          INACTIVE             0  30          INACTIVE
   104  40                             115  50                             125  60
   162  70                             175  80                             202  90
```

```
STATISTICS  -
  PROGRAM LENGTH                  250B      168
```

```
CONTROL*VRLX.VECTOR                                             9/14/76 VORLAX    3484
C...                                                                    VORLAX    3485
      SUBROUTINE VECTOR (ITOTAL, NX1, AV, EW, VOR1, VORK, VORL)         VORLAX    3486
C                                                                       VORLAX    3487
C                                                                       VORLAX    3488
C...PURPOSE    TO SOLVE THE LINEAR SYSTEM OF BOUNDARY CONDITION         VORLAX    3489
C...           EQUATIONS BY PURCELL≠S VECTOR ORTHOGONALIZATION          VORLAX    3490
C...           METHOD.                                                  VORLAX    3491
C...                                                                    VORLAX    3492
C...INPUT      CALLING SEQUENCES                                        VORLAX    3493
C...           ITOTAL = TOTAL NUMBER OF HORSESHOE VORTICES.             VORLAX    3494
C...           NX1 = ITOTAL + 1  .                                      VORLAX    3495
C...           EW = ROW OF NORMALWASH INFLUENCE COEFFICIENT MATRIX.     VORLAX    3496
C...           COMMONS                                                  VORLAX    3497
C...           ALOC.                                                    VORLAX    3498
C...                                                                    VORLAX    3499
C...OUTPUT     CALLING SEQUENCES                                        VORLAX    3500
C...           VOR1 = AUXILIARY COMPUTATIONAL ROW VECTOR.               VORLAX    3501
C...           VORK = EXTENDED SOLUTION ROW VECTOR.                     VORLAX    3502
C...           VORL = AUXILIARY COMPUTATIONAL ROW VECTOR.               VORLAX    3503
C...           COMMONS                                                  VORLAX    3504
C...           GAMMA.                                                   VORLAX    3505
C...                                                                    VORLAX    3506
C...SUBROUTINES                                                         VORLAX    3507
C...CALLED     NONE.                                                    VORLAX    3508
C...                                                                    VORLAX    3509
C...DISCUSSION THE BOUNDARY CONDITION EQUATIONS ARE SOLVED DIRECTLY     VORLAX    3510
C...           BY A VECTOR ORTHOGONALIZATION PROCEDURE (PURCELL≠S       VORLAX    3511
C...           VECTOR METHOD). SETS OF LINEARLY INDEPENDENT VECTORS     VORLAX    3512
C...           ARE CONSTRUCTED WHICH ARE SUCCESIVELY ORTHOGONAL TO      VORLAX    3513
C...           EACH ROW. WHEN ALL ROWS HAVE BEEN CONSIDERED THERE IS    VORLAX    3514
C...           ONE VECTOR WHICH IS NORMAL (ORTHOGONAL) TO ALL ROWS      VORLAX    3515
C...           AND CONTAINS THE SOLUTION VECTOR. NO MATRIX INVERSION    VORLAX    3516
C...           IS INVOLVED AND ONLY ONE ROW OF THE COEFFICIENT MATRIX   VORLAX    3517
C...           IS REQUIRED AT A TIME, AND ONCE OPERATED ON CAN BE       VORLAX    3518
C...           OVERWRITTEN. IN ADDITION, TWO AUXILIARY ROW VECTORS      VORLAX    3519
C...           ARE NEEDED FOR TEMPORARY STORAGE OF INTERMEDIATE VECTOR  VORLAX    3520
C...           VECTOR DATA.                                             VORLAX    3521
C...                                                                    VORLAX    3522
C...                                                                    VORLAX    3523
      COMMON /SET6 /TITLE (20), HEAD (200), ALOC (2000)                 VORLAX    3524
      COMMON /SET16 /GAMMA  ( 2000 ) , ONSET  (200)                     VORLAX    3525
C                                                                       VORLAX    3526
      DIMENSION AV (NX1), VOR1 (NX1), VORK (NX1), VORL (NX1)            VORLAX    3527
      DIMENSION EW (ITOTAL)                                             VORLAX    3528
C                                                                       VORLAX    3529
C                                                                       VORLAX    3530
C                                                                       VORLAX    3531
C ***************** SOLUTION BY VECTOR METHOD ************************  VORLAX    3532
C                                                                       VORLAX    3533
      REWIND 1                                                          VORLAX    3534
C                                                                       VORLAX    3535
C...UNITS 11 AND 12 ARE TEMPORARY DATA STORAGE. DATA STORED IN THESE    VORLAX    3536
C...UNITS ARE NOT USED ANYWHERE ELSE IN THE PROGRAM.                    VORLAX    3537
C                                                                       VORLAX    3538
      REWIND 11                                                         VORLAX    3539
      REWIND 12                                                         VORLAX    3540
      C                                                                  VORLAX   3541
      C                                                                  VORLAX   3542
      C...ALL VECTORS ARE EXTENDED, I.E., THEY HAVE A DIMENSION EQUAL TO VORLAX   3543
      C...THE NUMBER OF UNKNOWNS PLUS ONE.                               VORLAX   3544
      C                                                                  VORLAX   3545
      C     NX1 = ITOTAL + 1                                             VORLAX   3546
      C                                                                  VORLAX   3547
      C...DEFINE INITIAL SET OF VECTORS WITH #DIAGONAL# ELEMENTS EQUAL TO VORLAX  3548
      C...UNITY, AND ALL OTHER ELEMENTS ZEROED OUT.                      VORLAX   3549
      C                                                                  VORLAX   3550
            DO 20 K = 1, NX1                                             VORLAX   3551
            DO 10 J = 1, NX1                                             VORLAX   3552
            VORK (J) = 0.0                                               VORLAX   3553
            IF (J .EQ. K) VORK (J) = 1.0                                 VORLAX   3554
         10 CONTINUE                                                     VORLAX   3555
            WRITE (11) VORK                                              VORLAX   3556
         20 CONTINUE                                                     VORLAX   3557
      C                                                                  VORLAX   3558
      C                                                                  VORLAX   3559
      C...COMPUTE SUCCESSIVE SETS OF INTERMEDIATE VECTORS. THE JTH SET   VORLAX   3560
      C...CONTAINS (NX1 - J) VECTORS WHICH ARE NORMAL (ORTHOGONAL) TO THE VORLAX  3561
      C...FIRST J VECTORS. CONSEQUENTLY THE LAST SET (J = ITOTAL) IS ORTHO VORLAX 3562
      C...GONAL TO ALL THE VECTORS AND IT CONTAINS THE SOLUTION OF THE   VORLAX   3563
      C...LINEAR SYSTEM (THE FIRST ITOTAL OF THE NX1 ELEMENTS, I.E., ALL VORLAX   3564
      C...THE ELEMENTS BUT THE LAST ONE ARE THE VALUES OF THE UNKNOWNS). VORLAX   3565
      C                                                                  VORLAX   3566
            REWIND 11                                                    VORLAX   3567
            IN = 11                                                      VORLAX   3568
            DO 80 JJ = 1, ITOTAL                                         VORLAX   3569
         12 IM = 23 - IN                                                 VORLAX   3570
            READ (1) EW                                                  VORLAX   3571
            READ (IN) VORI                                               VORLAX   3572
            DO 30 I = 1, NX1                                             VORLAX   3573
            IF (I .LT. NX1) AV (I) = EW (I)                              VORLAX   3574
            IF (I .EQ. NX1) AV (I) = - ALOC (JJ)                         VORLAX   3575
         30 CONTINUE                                                     VORLAX   3576
            RDEN = 0.0                                                   VORLAX   3577
            DO 40 I = 1, NX1                                             VORLAX   3578
            RDEN = RDEN + AV (I) *VORI (I)                               VORLAX   3579
         40 CONTINUE                                                     VORLAX   3580
            NTOP = NX1 - JJ                                              VORLAX   3581
            DO 70 KK = 1, NTOP                                           VORLAX   3582
            READ (IN) VORL                                               VORLAX   3583
            RNUM = 0.0                                                   VORLAX   3584
            DO 50 I = 1, NX1                                             VORLAX   3585
            RNUM = RNUM + AV (I) *VORL (I)                               VORLAX   3586
         50 CONTINUE                                                     VORLAX   3587
            CJK = - RNUM /RDEN                                           VORLAX   3588
            DO 60 I = 1, NX1                                             VORLAX   3589
            VORK (I) = CJK *VORI (I) + VORL (I)                          VORLAX   3590
         60 CONTINUE                                                     VORLAX   3591
            WRITE (IM) VORK                                              VORLAX   3592
         70 CONTINUE                                                     VORLAX   3593
            REWIND 11                                                    VORLAX   3594
            REWIND 12                                                    VORLAX   3595
            IN = IM                                                      VORLAX   3596
         80 CONTINUE                                                     VORLAX   3597
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     SUBROUTINE VECTOR     74/74   OPT=1                        FTN 4.5+410A       10/04/76  10.15.13       PAGE     3

 115          C                                                                       VORLAX    3598
              C     VORK  IS  THE  EXTENDED  SOLUTION  ROW  VECTOR                    VORLAX    3599
              C                                                                       VORLAX    3600
              C  **************** END OF SOLUTION BY VECTOR METHOD ****************   VORLAX    3601
              C                                                                       VORLAX    3602
 120           90   DO 100 IR = 1, ITOTAL                                             VORLAX    3603
                    GAMMA (IR) = VORK (IR)                                            VORLAX    3604
              100   CONTINUE                                                          VORLAX    3605
              C                                                                       VORLAX    3606
                    REWIND 1                                                          VORLAX    3607
 125          C                                                                       VORLAX    3608
                    RETURN                                                            VORLAX    3609
                    END                                                               VORLAX    3610


     SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
     3  VECTOR

VARIABLES      SN   TYPE            RELOCATION
   334  ALOC        REAL         ARRAY     SET6                0  AV         REAL        ARRAY     F.P.
   244  CJK         REAL                                       0  FW         REAL        ARRAY     F.P.
     0  GAMMA       REAL         ARRAY     SET16              24  HEAD       REAL        ARRAY     SET6
   237  I           INTEGER                                  236  IM         INTEGER
   234  IN          INTEGER                                  245  IP         INTEGER
     0  ITOTAL      INTEGER                F.P.              233  J          INTEGER
   235  JJ          INTEGER                                  232  K          INTEGER
   242  KK          INTEGER                                  241  NTOP       INTEGER
     0  NX1         INTEGER                F.P.             3720  ONSET      REAL        ARRAY     SET16
   240  RDEN        REAL                                     243  RNU4       REAL
     0  TITLE       REAL         ARRAY     SET6                0  VORK       REAL        ARRAY     F.P.
     0  VORL        REAL         ARRAY     F.P.                0  VORI       REAL        ARRAY     F.P.

FILE NAMES         MODE
      TAPE1        UNFMT                   TAPE11     UNFMT                TAPE12

STATEMENT LABELS
     0  10                                  0  20                                  0  30
     0  40                                  0  50                                  0  60
     0  70                                  0  80                                  0  90          INACTIVE
     0  100

LOOPS  LABEL      INDEX      FROM-TO     LENGTH      PROPERTIES
   26   20      * K          68  74       20B                    EXT REFS  NOT INNER
   27   10        J          69  72        4B          INSTACK
   47   80      * JJ         86 114      116B                    EXT REFS  NOT INNER
   71   30        I          90  93        7B          INSTACK
  105   40        I          95  97        4B          INSTACK
  115   70      * KK         99 110       41B                    EXT REFS  NOT INNER
  127   50        I         102 104        4B          INSTACK
  142   60        I         106 108        3B          INSTACK
  171  100        IR        120 122        2B          INSTACK
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       SUBROUTINE VECTOR      74/74    OPT=1                                     FTN 4.5+410A        10/04/76  10.15.13        PAGE      4

COMMON BLOCKS   LENGTH
       SET6        2220
       SET16       4000

STATISTICS
  PROGRAM LENGTH                  311B      201
  CM LABELED COMMON LENGTH      14114B     6220
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      CONTROL*VRLX.WASH                                         9/14/76  VORLAX   3611
      C...                                                               VORLAX   3612
            SUBROUTINE WASH (X, Y, Z, S, T, B2, U, V, W, AA, AM, TE, CT, MM)   VORLAX   3613
      C...                                                               VORLAX   3614
      C...PURPOSE    TO COMPUTE THE THREE VELOCITY COMPONENTS INDUCED AT A VORLAX   3615
      C...           GIVEN POINT BY A GENERALIZED HORSESHOE VORTEX OF UNIT VORLAX   3616
      C...           STRENGTH.                                           VORLAX   3617
      C                                                                  VORLAX   3618
      C...INPUT      CALLING SEQUENCES                                   VORLAX   3619
      C...           X, Y, Z = ORTHOGONAL CARTESIAN COORDINATES OF       VORLAX   3620
      C...                     RECEIVING (FIELD OR CONTROL) POINT MEASURED VORLAX 3621
      C...                     IN A REFERENCE FRAME CENTERED AT THE MIDPOINT VORLAX 3622
      C...                     OF THE TRANSVERSE VORTEX SEGMENT (HORSESHOE VORLAX 3623
      C...                     VORTEX CENTROID). THE X-AXIS IS PARALLEL TO VORLAX 3624
      C...                     THE X-AXIS OF THE MASTER (CONFIGURATION)  VORLAX   3625
      C...                     COORDINATE SYSTEM, THE Y-AXIS IS NORMAL TO VORLAX  3626
      C...                     THE X-AXIS BUT LIES IN THE PLANE DETERMINED VORLAX 3627
      C...                     BY THE X-AXIS ITSELF AND THE TRANSVERSE LEG VORLAX 3628
      C...                     OF THE HORSESHOE, AND THE Z-AXIS IS NORMAL VORLAX  3629
      C...                     TO SUCH PLANE.                            VORLAX   3630
      C...           S = HORSESHOE VORTEX SEMISPAN.                      VORLAX   3631
      C...           T = TANGENT OF SWEEP ANGLE OF TRANSVERSE LEG, POSITIVE VORLAX 3632
      C...               FOR SWEEPBACK.                                  VORLAX   3633
      C...           B2 = COMPRESSIBILITY FACTOR (= MACH **2 - 1.0).     VORLAX   3634
      C...           AA, AM = DIRECTION ANGLES (ANGLES OF FLOATATION) OF VORLAX   3635
      C...                    FREE (WAKE) TRAILING LEGS.                 VORLAX   3636
      C...           TE = TANGENT OF TRAILING EDGE SWEEP ANGLE.          VORLAX   3637
      C...           CT = AVERAGE LENGTH OF BOUND TRAILING LEGS OF HORSESHOE VORLAX 3638
      C...                (DISTANCE BETWEEN VORTEX CENTROID AND TRAILING VORLAX   3639
      C...                EDGE MEASURED ALONG X-AXIS).                   VORLAX   3640
      C...           MM = FLOATING WAKE COMPUTATION FLAG.                VORLAX   3641
      C...           COMMONS                                             VORLAX   3642
      C...           NONE.                                               VORLAX   3643
      C...                                                               VORLAX   3644
      C...OUTPUT     CALLING SEQUENCES                                   VORLAX   3645
      C...           U, V, W = ORTHOGONAL VELOCITY COMPONENTS INDUCED BY VORLAX   3646
      C...                     GENERALIZED HORSESHOE VORTEX OF UNIT      VORLAX   3647
      C...                     CIRCULATION INTENSITY.                    VORLAX   3648
      C...                                                               VORLAX   3649
      C...SUBROUTINES                                                    VORLAX   3650
      C...CALLED     NONE.                                               VORLAX   3651
      C...                                                               VORLAX   3652
      C...DISCUSSION THE (GENERALIZED) HORSESHOE VORTEX ELEMENT CONSISTS OF VORLAX 3653
      C...           FIVE LEGS OR SEGMENTS, OF WHICH THREE ARE (BOUND) AND VORLAX 3654
      C...           TWO ARE (FREE) OR (FLOATING). THE BOUND LEGS ARE THE VORLAX  3655
      C...           SKEWED, OR SWEPT, TRANSVERSE SEGMENT AND THE TWO    VORLAX   3656
      C...           TRAILING, OR CHORDWISE, FILAMENTS EXTENDING FROM THE VORLAX  3657
      C...           ENDS OF THE TRANSVERSE LEG TO THE TRAILING EDGE. THE VORLAX  3658
      C...           FLOATING TRAILING LEGS ARE THE SEMI-INFINITE LINES  VORLAX   3659
      C...           WHICH START AT THE TRAILING EDGE AND CONTINUE TO    VORLAX   3660
      C...           DOWNSTREAM INFINITY ACCORDING TO A PRESCRIBED DIRECTION VORLAX 3661
      C...           DETERMINED BY THE FLOATATION ANGLES AA AND AM. THESE VORLAX  3662
      C...           FLOATING TRAILING LEGS CONSTITUTE THE CONTINUATION  VORLAX   3663
      C...           IN THE WAKE OF THE BOUND TRAILING SEGMENTS.         VORLAX   3664
      C...           AT SUPERSONIC MACH NUMBERS THE VELOCITY INDUCED BY A VORLAX  3665
      C...           DISCRETE HORSESHOE VORTEX BECOMES VERY LARGE IN THE VORLAX   3666
      C...           VICINITY OF THE MACH AFTCONES GENERATED BY THE SKEWED VORLAX 3667
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C...          LEG OF THE HORSESHOE. AT THE CHARACTERISTIC ENVELOPE   VORLAX   3668
C...          ITSELF, THE INDUCED VELOCITY VANISHES DUE TO THE FINITE VORLAX   3669
C...          PART CONCEPT. THIS SINGULAR BEHAVIOR OCCURS ONLY FOR   VORLAX   3670
C...          FIELD POINTS OFF THE PLANE OF THE HORSESHOE. TO AVOID  VORLAX   3671
C...          THIS NUMERICAL SINGULARITY THE CHARACTERISTIC SURFACES VORLAX   3672
C...          (MACH CONES) ARE TAKEN TO BE GIVEN BY                  VORLAX   3673
C...          (X - X1) **2 = B2 *((Y - Y1) **2 + (Z -Z1) **2) /CUTOFF VORLAX   3674
C...          WHERE CUTOFF IS A NUMERICAL CONSTANT WHOSE VALUE IS    VORLAX   3675
C...          LESS THAN, BUT CLOSE TO, 1.0 .                         VORLAX   3676
C...                                                                 VORLAX   3677
C...                                                                 VORLAX   3678
C...                                                                 VORLAX   3679
      CUTOFF = 0.80                                                  VORLAX   3680
C                                                                    VORLAX   3681
C...COMPUTE COORDINATES OF RECEIVING POINT WITH RESPECT TO           VORLAX   3682
C...END POINTS OF SKEWED LEG.                                        VORLAX   3683
C                                                                    VORLAX   3684
      X1 = X + T *S                                                  VORLAX   3685
      Y1 = Y + S                                                     VORLAX   3686
      X2 = X - T *S                                                  VORLAX   3687
      Y2 = Y - S                                                     VORLAX   3688
C                                                                    VORLAX   3689
C...CALCULATE AXIAL DISTANCE BETWEEN PROJECTION OF RECEIVING POINT   VORLAX   3690
C...ONTO HORSESHOE PLANE AND EXTENSION OF SKEWED LEG.                VORLAX   3691
C                                                                    VORLAX   3692
      XTY = X - T *Y                                                 VORLAX   3693
C                                                                    VORLAX   3694
C...ZERO-OUT PERTURBATION VELOCITY COMPONENTS.                       VORLAX   3695
C                                                                    VORLAX   3696
      U = 0.                                                         VORLAX   3697
      V = 0.                                                         VORLAX   3698
      W = 0.                                                         VORLAX   3699
C                                                                    VORLAX   3700
C...SET VALUES OF NUMERICAL TOLERANCE CONSTANTS.                     VORLAX   3701
C                                                                    VORLAX   3702
      TOL = S /500.0                                                 VORLAX   3703
      TOLSQ = TOL *TOL                                               VORLAX   3704
      TOLSQ2 = 2500.0 *TOLSQ                                         VORLAX   3705
      ZSQ = Z *Z                                                     VORLAX   3706
      BZQ = B2 *ZSQ                                                  VORLAX   3707
      YSQ1 = Y1 *Y1                                                  VORLAX   3708
      YSQ2 = Y2 *Y2                                                  VORLAX   3709
      RTV1 = YSQ1 + ZSQ                                              VORLAX   3710
      RTV2 = YSQ2 + ZSQ                                              VORLAX   3711
      RO1  = B2 *RTV1                                                VORLAX   3712
      RO2  = B2 *RTV2                                                VORLAX   3713
      RAD1 = 0.0                                                     VORLAX   3714
      RAD2 = 0.0                                                     VORLAX   3715
      XSQ1 = X1 *X1                                                  VORLAX   3716
      XSQ2 = X2 *X2                                                  VORLAX   3717
      IF (B2) 10, 50, 50                                             VORLAX   3718
C                                                                    VORLAX   3719
C                                                                    VORLAX   3720
C...COMPUTATION FOR SUBSONIC HORSESHOE VORTEX.                       VORLAX   3721
C                                                                    VORLAX   3722
C                                                                    VORLAX   3723
 10   CPI = 12.56630                                                 VORLAX   3724
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      ARG = XSQ1 - RO1                                                  VORLAX    3725
      RAD1 = SQRT (ARG)                                                 VORLAX    3726
      ARG = XSQ2 - RO2                                                  VORLAX    3727
      RAD2 = SQRT (ARG)                                                 VORLAX    3728
      FB1 = 0.0                                                         VORLAX    3729
      FB2 = 0.0                                                         VORLAX    3730
      FT1 = 0.0                                                         VORLAX    3731
      FT2 = 0.0                                                         VORLAX    3732
      XBSQ = XTY *XTY                                                   VORLAX    3733
      TBZ = (T *T - B2) *ZSQ                                            VORLAX    3734
      DENOM = XBSQ + TBZ                                                VORLAX    3735
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = TOLSQ                         VORLAX    3736
      FB1 = (T *X1 - B2 *Y1) /RAD1                                      VORLAX    3737
      RTV = RTV1                                                        VORLAX    3738
      IF (RTV .LT. TOLSQ) GO TO 20                                      VORLAX    3739
      FT1 = (X1 + RAD1) /(RAD1 *RTV)                                    VORLAX    3740
   20 FB2 = (T *X2 - B2 *Y2) /RAD2                                      VORLAX    3741
      RTV = RTV2                                                        VORLAX    3742
      IF (RTV .LT. TOLSQ) GO TO 30                                      VORLAX    3743
      FT2 = (X2 + RAD2) /(RAD2 *RTV)                                    VORLAX    3744
   30 QB = (FB1 - FB2) /DENOM                                           VORLAX    3745
      ZETAPI = Z /CPI                                                   VORLAX    3746
      IF (ZSQ .LT. TOLSQ) GO TO 40                                      VORLAX    3747
      U = ZETAPI *QB                                                    VORLAX    3748
      V = ZETAPI * (FT1 - FT2 - QB *T)                                  VORLAX    3749
   40 W = - (QB *XTY + FT1 *Y1 - FT2 *Y2) /CPI                          VORLAX    3750
      GO TO 110                                                         VORLAX    3751
C                                                                       VORLAX    3752
C                                                                       VORLAX    3753
C...COMPUTATION FOR SUPERSONIC HORSESHOE VORTEX.                        VORLAX    3754
C                                                                       VORLAX    3755
C                                                                       VORLAX    3756
   50 CPI = 6.28318                                                     VORLAX    3757
      IF (X1 .LT. TOL) GO TO 60                                         VORLAX    3758
      ARG = XSQ1 - RO1                                                  VORLAX    3759
      IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)                               VORLAX    3760
   60 IF (X2 .LT. TOL) GO TO 70                                         VORLAX    3761
      ARG = XSQ2 - RO2                                                  VORLAX    3762
      IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)                               VORLAX    3763
   70 ZETAPI = Z /CPI                                                   VORLAX    3764
      IF (ZSQ .LT. TOLSQ2) GO TO 100                                    VORLAX    3765
      FB1 = 0.0                                                         VORLAX    3766
      FB2 = 0.0                                                         VORLAX    3767
      FT1 = 0.0                                                         VORLAX    3768
      FT2 = 0.0                                                         VORLAX    3769
      XBSQ = XTY *XTY                                                   VORLAX    3770
      TBZ = (T *T - B2) *ZSQ                                            VORLAX    3771
      DENOM = XBSQ + TBZ                                                VORLAX    3772
      SIGN = 1.0                                                        VORLAX    3773
      IF (DENOM .LT. 0.0) SIGN = - 1.0                                  VORLAX    3774
      IF (ABS (DENOM) .LT. TOLSQ) DENOM = SIGN *TOLSQ                   VORLAX    3775
      IF (X1 .LT. TOL) GO TO 80                                         VORLAX    3776
      IF (RAD1 .EQ. 0.0) GO TO 80                                       VORLAX    3777
      REPS = CUTOFF *XSQ1                                               VORLAX    3778
      FRAD = RAD1                                                       VORLAX    3779
      IF (RO1 .GT. REPS) GO TO 80                                       VORLAX    3780
      FB1 = (T *X1 - B2 *Y1) /FRAD                                      VORLAX    3781
      RTV = RTV1                                                        VORLAX  3782
      IF (RTV .LT. TOLSQ) GO TO 80                                      VORLAX  3783
      FT1 = X1 /(FRAD *RTV)                                             VORLAX  3784
   80 IF (X2 .LT. TOL) GO TO 90                                         VORLAX  3785
      IF (RAD2 .EQ. 0.0) GO TO 90                                       VORLAX  3786
      REPS = CUTOFF *XSQ2                                               VORLAX  3787
      FRAD = RAD2                                                       VORLAX  3788
      IF (RO2 .GT. REPS) GO TO 90                                       VORLAX  3789
      FB2 = (T *X2 - B2 *Y2) /FRAD                                      VORLAX  3790
      RTV = RTV2                                                        VORLAX  3791
      IF (RTV .LT. TOLSQ) GO TO 90                                      VORLAX  3792
      FT2 = X2 /(FRAD *RTV)                                             VORLAX  3793
   90 QB = (FB1 - FB2) /DENOM                                           VORLAX  3794
      U = ZETAPI *QB                                                    VORLAX  3795
      V = ZETAPI *(FT1 - FT2 - QB *T)                                   VORLAX  3796
      W = - (QB *XTY + FT1 *Y1 - FT2 *Y2) /CPI                          VORLAX  3797
      GO TO 110                                                         VORLAX  3798
C                                                                       VORLAX  3799
C...COMPUTATION FOR SUPERSONIC HORSESHOE VORTEX WHEN RECEIVING POINT     VORLAX  3800
C...IS IN THE PLANE OF THE HORSESHOE.                                   VORLAX  3801
C                                                                       VORLAX  3802
  100 F1 = 0.                                                           VORLAX  3803
      F2 = 0.                                                           VORLAX  3804
      IF (ABS (Y1) .GT. TOL) F1 = RAD1 /Y1                              VORLAX  3805
      IF (ABS (Y2) .GT. TOL) F2 = RAD2 /Y2                              VORLAX  3806
      IF (ABS (XTY) .GT. TOL) W = (- F1 + F2) /XTY /CPI                 VORLAX  3807
  110 IF (MM .EQ. 0) GO TO 200                                          VORLAX  3808
C                                                                       VORLAX  3809
C                                                                       VORLAX  3810
C...IF THE FREE TRAILING LEGS DO NOT CONTINUE TO DOWNSTREAM INFINITY     VORLAX  3811
C...PARALLEL TO X-AXIS, I.E., WAKE FLOATATION FLAG MM IS NOT ZERO,      VORLAX  3812
C...THEN THE EFFECT OF WAKE FLOATATION ANGLES IS COMPUTED BY FIRST      VORLAX  3813
C...SUBTRACTING THE VELOCITY INDUCED BY THE SEMI-INFINITE SEGMENTS      VORLAX  3814
C...PARALLEL TO THE X-AXIS AND EMANATING FROM THE TRAILING EDGE, AND    VORLAX  3815
C...LATER ADDING THE INFLUENCE INDUCED BY THE SEMI-INFINITE PAIR        VORLAX  3816
C...ORIGINATING AT THE SAME POINTS BUT TRAILING TO DOWNSTREAM INFINITY  VORLAX  3817
C...PARALLEL TO THE DIRECTION DEFINED BY THE FLOATATION ANGLES AA AND   VORLAX  3818
C...AM.                                                                 VORLAX  3819
C                                                                       VORLAX  3820
C                                                                       VORLAX  3821
      XMP = X - CT                                                      VORLAX  3822
      X1 = XMP + TE *S                                                  VORLAX  3823
      X2 = XMP - TE *S                                                  VORLAX  3824
      ZZ = Z - XMP *AA                                                  VORLAX  3825
      DELU = 0.0                                                        VORLAX  3826
      DELV = 0.0                                                        VORLAX  3827
      DELW = 0.0                                                        VORLAX  3828
      ZSQ = ZZ *ZZ                                                      VORLAX  3829
      BZQ = B2 *ZSQ                                                     VORLAX  3830
      RO1 = B2 *YSQ1 + BZQ                                              VORLAX  3831
      RO2 = B2 *YSQ2 + BZQ                                              VORLAX  3832
      RAD1 = 0.0                                                        VORLAX  3833
      RAD2 = 0.0                                                        VORLAX  3834
      XSQ1 = X1 *X1                                                     VORLAX  3835
      XSQ2 = X2 *X2                                                     VORLAX  3836
      XMY1 = AM *X1 - Y1                                                VORLAX  3837
      XMY2 = AM *X2 - Y2                                                VORLAX  3838
      IF (B2) 120, 130, 130                             VORLAX   3839
120   ARG = XSQ1 - RO1                                  VORLAX   3840
      RAD1 = SQRT (ARG)                                 VORLAX   3841
      ARG = XSQ2 - RO2                                  VORLAX   3842
      RAD2 = SQRT (ARG)                                 VORLAX   3843
      GO TO 150                                         VORLAX   3844
130   IF (X1 .LT. TOL) GO TO 140                        VORLAX   3845
      ARG = XSQ1 - RO1                                  VORLAX   3846
      IF (ARG .GT. 0.0) RAD1 = SQRT (ARG)               VORLAX   3847
140   IF (X2 .LT. TOL) GO TO 150                        VORLAX   3848
      ARG = XSQ2 - RO2                                  VORLAX   3849
      IF (ARG .GT. 0.0) RAD2 = SQRT (ARG)               VORLAX   3850
150   GG1 = 0.0                                         VORLAX   3851
      GG2 = 0.0                                         VORLAX   3852
      R1 = SQRT ((1. - CUTOFF) *XSQ1)                   VORLAX   3853
      R2 = SQRT ((1. - CUTOFF) *XSQ2)                   VORLAX   3854
      DR1 = 0.0                                         VORLAX   3855
      DR2 = 0.0                                         VORLAX   3856
      IF (RAD1 .GT. R1) DR1 = 1.0 /RAD1                 VORLAX   3857
      IF (RAD2 .GT. R2) DR2 = 1.0 /RAD2                 VORLAX   3858
      BAM = 1.0 - B2 *AM *AM                            VORLAX   3859
      BMZ = BAM *ZSQ                                    VORLAX   3860
      DG1 = XMY1 *XMY1 + BMZ                            VORLAX   3861
      DG2 = XMY2 *XMY2 + BMZ                            VORLAX   3862
      GN1 = X1 - B2 *AM *Y1                             VORLAX   3863
      GN2 = X2 - B2 *AM *Y2                             VORLAX   3864
      IF (ABS (DG1) .LT. TOLSQ) DG1 = TOLSQ             VORLAX   3865
      IF (ABS (DG2) .LT. TOLSQ) DG2 = TOLSQ             VORLAX   3866
      GINF = 0.0                                        VORLAX   3867
      IF (B2 .LT. 0.0) GINF = - SQRT (BAM)              VORLAX   3868
      GG1 = (GN1*DR1 - GINF) /DG1                       VORLAX   3869
      GG2 = (GN2 *DR2 - GINF) /DG2                      VORLAX   3870
      FZETA1 = 0.0                                      VORLAX   3871
      FZETA2 = 0.0                                      VORLAX   3872
      ETA1 = 0.0                                        VORLAX   3873
      ETA2 = 0.0                                        VORLAX   3874
      IF (RTV1 .LT. TOLSQ) GO TO 160                    VORLAX   3875
      FZETA1 = ZETAPI /RTV1                             VORLAX   3876
      ETA1 = Y1 /CPI /RTV1                              VORLAX   3877
160   IF (RTV2 .LT. TOLSQ) GO TO 170                    VORLAX   3878
      FZETA2 = ZETAPI /RTV2                             VORLAX   3879
      ETA2 = Y2 /CPI /RTV2                              VORLAX   3880
170   IF (B2 .GE. 0.0) GO TO 180                        VORLAX   3881
      DELV = DELV - FZETA1 + FZETA2                     VORLAX   3882
      DELW = DELW + ETA1 - ETA2                         VORLAX   3883
180   DELV = DELV - DR1 *X1 *FZETA1 + DR2 *X2 *FZETA2   VORLAX   3884
      DELW = DELW + DR1 *X1 *ETA1 - DR2 *X2 *ETA2       VORLAX   3885
190   DELU = DELU + (GG2 - GG1) *AM *ZZ /CPI            VORLAX   3886
      DELV = DELV - (GG2 - GG1) *ZZ /CPI                VORLAX   3887
      DELW = DELW + (GG1 *XMY1 - GG2 *XMY2) /CPI        VORLAX   3888
      U = U + DELU                                      VORLAX   3889
      V = V + DELV                                      VORLAX   3890
      W = W + DELW                                      VORLAX   3891
200   RETURN                                            VORLAX   3892
      END                                               VORLAX   3893
      SUBROUTINE WASH       74/74   OPT=1                          FTN 4.5+410A        10/04/76  19.15.13        PAGE      6


      SYMBOLIC REFERENCE MAP (R=1)

ENTRY POINTS
    3  WASH

VARIABLES       SN   TYPE              RELOCATION
     0  AA          REAL                    F.P.           0   AM         REAL                     F.P.
   562  ARG         REAL                                 617   BAM        REAL
   620  BMZ         REAL                                 546   BZO        REAL
     0  B2          REAL                    F.P.         561   CPI        REAL
     0  CT          REAL                    F.P.         534   CUTOFF     REAL
   604  DELU        REAL                                 605   DELV       REAL
   606  DELW        REAL                                 571   DENOM      REAL
   621  DG1         REAL                                 622   DG2        REAL
   615  DR1         REAL                                 616   DR2        REAL
   630  ETA1        REAL                                 631   ETA2       REAL
   563  FB1         REAL                                 564   FB2        REAL
   577  FRAD        REAL                                 565   FT1        REAL
   566  FT2         REAL                                 626   FZETA1     REAL
   627  FZETA2      REAL                                 600   F1         REAL
   601  F2          REAL                                 611   GG1        REAL
   612  GG2         REAL                                 625   GINF       REAL
   623  GN1         REAL                                 624   GN2        REAL
     0  NN          INTEGER                 F.P.         573   PH         REAL
   555  RAD1        REAL                                 556   RAD2       REAL
   576  REPS        REAL                                 553   RO1        REAL
   554  RO2         REAL                                 572   RTV        REAL
   551  RTV1        REAL                                 552   RTV2       REAL
   613  R1          REAL                                 614   R2         REAL
     0  S           REAL                    F.P.         575   SIGN       REAL
     0  T           REAL                    F.P.         570   TBZ        REAL
     0  TE          REAL                    F.P.         542   TOL        REAL
   543  TOLSQ       REAL                                 544   TOLSQ2     REAL
     0  U           REAL                    F.P.           0   V          REAL                     F.P.
     0  W           REAL                    F.P.           0   X          REAL                     F.P.
   567  XBSQ        REAL                                 602   XMP        REAL
   607  XMY1        REAL                                 610   XMY2       REAL
   557  XSQ1        REAL                                 560   XSQ2       REAL
   541  XTY         REAL                                 535   X1         REAL
   537  X2          REAL                                   0   Y          REAL                     F.P.
   547  YSQ1        REAL                                 550   YSQ2       REAL
   536  Y1          REAL                                 540   Y2         REAL
     0  Z           REAL                    F.P.         574   ZETAP1     REAL
   545  ZSQ         REAL                                 603   ZZ         REAL

EXTERNALS            TYPE    ARGS
        SQRT       REAL        1 LIBRARY

INLINE FUNCTIONS     TYPE    ARGS
        ABS        REAL        1   INTRIN

STATEMENT LABELS
     0  10          INACTIVE             100  20                                      111  30
   126  40                               135  50                                      146  60
   156  70                               221  80                                      240  90
   256  100                              300  110                                       0  120          INACTIVE
   342  130                              352  14                                      362  150
```

```
       SUBROUTINE ZNORM        74/74    OPT=1                                 FTN 4.5+410A       10/04/76  10.15.13        PAGE      3
 COMMON BLOCKS    LENGTH
       SET19         240

 STATISTICS
   PROGRAM LENGTH                  130B       88
   CM LABELED COMMON LENGTH      20452B     8490
   CM BLANK COMMON LENGTH            1B        1
```

```
      CONTROL*VRLX.ZNORM                                               9/14/76  VORLAX     3894
      C...                                                                      VORLAX     3895
            SUBROUTINE ZNORM (I, IS, RTOP)                                      VORLAX     3896
      C...                                                                      VORLAX     3897
      C...PURPOSE     TO INTEGRATE THE CHORDWISE SLOPE DISTRIBUTION IN ORDER    VORLAX     3898
      C...            TO OBTAIN THE SURFACE CAMBER (OR WARP) ORDINATES.         VORLAX     3899
      C                                                                         VORLAX     3900
      C...INPUT       CALLING SEQUENCES                                         VORLAX     3901
      C...            I = ELEMENT INDEX (TOTAL COUNT).                          VORLAX     3902
      C...            IS = STRIP INDEX (SPANWISE COUNT).                        VORLAX     3903
      C...            RNMAX = NUMBER OF HORSESHOE VORTICES IN A GIVEN STRIP     VORLAX     3904
      C...                   (CHORDWISE ROW).                                   VORLAX     3905
      C...            COMMONS                                                   VORLAX     3906
      C...            LAX, SLE, SLOPE.                                          VORLAX     3907
      C                                                                         VORLAX     3908
      C...OUTPUT      CALLING SEQUENCES                                         VORLAX     3909
      C...            NONE.                                                     VORLAX     3910
      C...            COMMONS                                                   VORLAX     3911
      C...            ZC.                                                       VORLAX     3912
      C...                                                                      VORLAX     3913
      C...SUBROUTINES                                                           VORLAX     3914
      C...CALLED      NONE.                                                     VORLAX     3915
      C...                                                                      VORLAX     3916
      C...DISCUSSION  THIS SUBROUTINE COMPUTES THE CAMBER NORMAL ORDINATES      VORLAX     3917
      C...            BY TRAPEZOIDAL INTEGRATION OF THE SURFACE SLOPE DIS       VORLAX     3918
      C...            TRIBUTION ALONG THE CHORD. THIS SUBROUTINE IS ONLY        VORLAX     3919
      C...            CALLED (BY SUBROUTINE PRINT) WHEN THE DESIGN PROCESS      VORLAX     3920
      C...            IS INVOKED (INVERS = 1). IN SUCH A CASE, THE LOAD DIS     VORLAX     3921
      C...            TRIBUTION HAS BEEN INPUT, AND THE SURFACE WARP NEEDED     VORLAX     3922
      C...            TO ACHIEVE IT IS THE DESIRED OUTPUT. THE CAMBERLINE IS    VORLAX     3923
      C...            DEFINED AS BEING ZERO AT THE LEADING EDGE AND IS          VORLAX     3924
      C...            EXPRESSED AS DECIMAL FRACTION OF THE LOCAL CHORD          VORLAX     3925
      C...            LENGTH. THE COMPUTED CAMBERLINE REPRESENTS THE TOTAL      VORLAX     3926
      C...            SURFACE WARP, I.E., IT INCLUDES CAMBER AND TWIST.         VORLAX     3927
      C...            SUBROUTINE ZNORM IS CALLED ONCE PER EACH CHORDWISE        VORLAX     3928
      C...            STRIP OR ROW OF HORSESHOE VORTICES.                       VORLAX     3929
      C                                                                         VORLAX     3930
      C                                                                         VORLAX     3931
      C                                                                         VORLAX     3932
            COMMON LAX                                                          VORLAX     3933
            COMMON /SET1 /X (2000), Y (100), Z (100), ZC (50)                   VORLAX     3934
            COMMON /SET2 /DCP (2000), SLOPE (2000), VSP (2000)                  VORLAX     3935
            COMMON /SET19 /SLE1 (20), SLE2 (20), SLE (100), ZETA (100)          VORLAX     3936
      C                                                                         VORLAX     3937
      C                                                                         VORLAX     3938
      C                                                                         VORLAX     3939
            FEQL = LAX                                                          VORLAX     3940
            FCOS = 1.0 - FEQL                                                   VORLAX     3941
            PION = (3.14159 *FCOS + FEQL) /RTOP                                 VORLAX     3942
            F1 = .75 *FCOS + .8333 *FEQL                                        VORLAX     3943
            F2 = .25 *FCOS + .1667 *FEQL                                        VORLAX     3944
      C                                                                         VORLAX     3945
            TSTART = F1 *SLE (IS) + F2 *SLOPE (I)                               VORLAX     3946
      C                                                                         VORLAX     3947
            DEL1 = .25 *PION                                                    VORLAX     3948
            DELX = DEL1 * (SIN (DEL1 *FCOS) + FEQL)                             VORLAX     3949
            ZOR = TSTART *DELX                                                  VORLAX     3950
```

```
                       DEL = PION *.5                                                      VORLAX    3951
                       LTOP = RTOP                                                         VORLAX    3952
   60             C                                                                        VORLAX    3953
                       DO 30 L = 1, LTOP                                                   VORLAX    3954
                       IL = I + L - 1                                                      VORLAX    3955
                       RL = L                                                              VORLAX    3956
                       IF (LAX .EQ. 1) GO TO 10                                            VORLAX    3957
   65                  DELXI = SIN (PION * (RL - 1.0))                                     VORLAX    3958
                       GO TO 20                                                            VORLAX    3959
                  10   DELXI = 2.0                                                         VORLAX    3960
                  20   ZC (L) = ZOR + DEL *DELXI *SLOPE (IL)                               VORLAX    3961
                       ZOR = ZC (L)                                                        VORLAX    3962
   70             30   CONTINUE                                                            VORLAX    3963
                  C                                                                        VORLAX    3964
                  C                                                                        VORLAX    3965
                       RETURN                                                              VORLAX    3966
                       END                                                                 VORLAX    3967


           SYMBOLIC REFERENCE MAP (R=1)

 ENTRY POINTS
     3  ZNORM

 VARIABLES       SN   TYPE            RELOCATION
     0  DCP           REAL        ARRAY     SET2             114  DEL         REAL
   112  DELX          REAL                                   121  DELXI       REAL
   111  DEL1          REAL                                   104  FCOS        REAL
   103  FEQL          REAL                                   106  F1          REAL
   107  F2            REAL                                     0  I           INTEGER                F.P.
   117  IL            INTEGER                                  0  IS          INTEGER                F.P.
   116  L             INTEGER                                  0  LAX         INTEGER                / /
   115  LTOP          INTEGER                                105  PION        REAL
   120  RL            REAL                                     0  RTOP        REAL                   F.P.
    50  SLE           REAL        ARRAY     SET19              0  SLE1        REAL        ARRAY      SET19
    24  SLE2          REAL        ARRAY     SET19           3720  SLOPE       REAL        ARRAY      SET2
   110  TSTART        REAL                                  7640  VSP         REAL        ARRAY      SET2
     0  X             REAL        ARRAY     SET1            3720  Y           REAL        ARRAY      SET1
  4064  Z             REAL        ARRAY     SET1            4230  ZC          REAL        ARRAY      SET1
   214  ZETA          REAL        ARRAY     SET19            113  ZOR         REAL

 EXTERNALS          TYPE    ARGS
       SIN        REAL       1 LIBRARY

 STATEMENT LABELS
    60  10                                 62  20                              0  30

 LOOPS  LABEL     INDEX     FROM-TO     LENGTH     PROPERTIES
    47  30      * L           61  70       23B                EXT REFS

 COMMON BLOCKS    LENGTH
        / /           1
        SET1       2250
        SET2       6000
```

```
      SUBROUTINE ZNORM      74/74    OPT=1                          FTN 4.5+410A        10/04/76  10.15.13        PAGE     3

COMMON BLOCKS   LENGTH
       SET19       240

STATISTICS
   PROGRAM LENGTH                  130B       88
   CM LABELED COMMON LENGTH      20452B     8490
   CM BLANK COMMON LENGTH            1B        1
```

```
LOAD MAP - VORLAX                                         CYBER LOADER 1.0-410       10/04/76  10.19.53.      PAGE      1


FWA OF THE LOAD             101
LWA+1 OF THE LOAD        205576

TRANSFER ADDRESS -- VORLAX        124001


PROGRAM AND BLOCK ASSIGNMENTS.

BLOCK        ADDRESS   LENGTH     FILE      DATE      PROCSSR VER LEVEL  HARDWARE   COMMENTS

/SET1/           101     4312
/SET2/          4413    13560
/SET3/         20173    17500
/SET4/         37673     1510
/SET5/         41403      670
/SET6/         42273     4254
/SET7/         46547      360
/SET8/         47127     1200
/SET9/         50327      310
/SET10/        50637     1274
/SET11/        52133       24
/SET12/        52157        7
/SET13/        52166        6
/SET14/        52174        4
/SET15/        52200        5
/SET16/        52205     7640
/SET17/        62045      360
/SET18/        62425       33
/SET19/        62460      360
/SET20/        63040    14210
VORLAX         77250    51231      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
AERO          150501     1022      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
BOUNDY        151523      204      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
GAUSS         151727      342      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
GEOM          152271      605      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
INPUT         153076     2750      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
MAP           156046      534      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
MATRX         156602     1345      LGO      10/04/76 FTN      4.5 410A   666X I      OPT=1
PRESS         160147      570      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
PRINT         160737     5414      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
SURVEY        166353     1136      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
UXVEL         167511      250      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
VECTOR        167761      311      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
WASH          170272      632      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
ZNORM         171124      130      LGO      10/04/76 FTN      4.5 410A   666A I      OPT=1
/FCL.C./      171254       23
/Q8.IO./      171277      131
COMIO=        171430       64  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               COMMON CODED I/O ROUTINES AND CONSTANTS.
Q8NTRY=       171430        0  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               FCL INITILALIZATION ROUTINE.
EOF           171514       16  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               TEST FOR END OF FILE STATUS.
FLTIN=        171532      154  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               COMMON FLOATING INPUT CONVERTER.
FMTAP=        171706      352  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               CRACK APLIST AND FORMAT FOR KODER/KRAKER.
FORUTL=       172260       16  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               FCL MISC. UTILITIES.
GETFIT=       172276       42  SL-FORTRAN  03/23/76 COMPASS  3. 2-410               LOCATE AN FIT GIVEN A FILE NAME.
/IO.BUF./     172340      227
```

```
LOAD MAP - VORLAX                                                   CYBER LOADER 1.0-410       10/04/76  10.19.53.       PAGE     2

  INPB=          172567         314  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             BINARY READ FORTRAN RECORD.
  KRAKER=        173103         406  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             PROCESS FORMATTED FORTRAN INPUT.
  OUTB=          173511         203  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             BINARY WRITE FORTRAN RECORD.
  OUTCOM=        173714         154  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             COMMON OUTPUT CODE
  REWIND=        174070          37  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             POSITION FILE AT BEGINNING-OF-INFORMATION.
  GOTOER=        174127          14  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             COMPUTED GO TO ERROR PROCESSOR.
  ALOG           174143          73  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             COMPUTE COMMON AND NATURAL LOGARITHMS. OPT-
  ATAN2          174236          73  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             ARCTAN OF RATIO OF Y TO X. OPT = ALL.
  EXP            174331          75  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             EXPONENTIAL FUNCTION. E TO POWER X. OPT=ALL
  SINCOS=        174426          66  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             TRIGONOMETRIC SINE OR COSINE OF X. OPT=ALL.
  SYSAID=        174514           1  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             LINK BETWEEN SYS=AID AND INITIALIZATION CON
  SYS=AID        174515           7  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             AUXILIARY MATH LIBRARY LINK FOR ERRORS.
  TAN=           174524          74  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             TANGENT OF X.
  XTOY=          174620           7  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             REAL TO REAL EXPONENTIATION.
  FECMSK=        174627          41  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             INITIALIZE CONSTANTS.
  FLTOUT=        174670         310  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             COMMON FLOATING OUTPUT CODE
  FORSYS=        175200         600  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             FORTRAN OBJECT LIBRARY UTILITIES.
  INCOM=         176000         277  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             COMMON INPUT FORMATTING CODE
  INPC=          176277         160  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             FORMATTED READ FORTRAN RECORD.
  KODER=         176457         456  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             OUTPUT FORMAT INTERPRETER.
  OUTC=          177135         172  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             FORMATTED WRITE FORTRAN RECORD.
  SQRT           177327          43  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             COMPUTE THE SQUARE ROOT OF X. OPT=ALL.
  SYS=1ST        177372          62  SL-FORTRAN  03/23/76 COMPASS  3. 2-410             MATH LIBRARY LINK TO ERROR MESSAGE PROCESS
  SYS.RM         177454          37  SL-SYSIO    03/12/75 COMPASS  3. 75010             PROCESS SYSTEM REQUEST.
  /CON.RM/       177513           6
  CIO.RM         177521          40  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /AOB.RM/       177561          10
  MOVE.RM        177571          64  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  NCT.RM         177655         227  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /JMPS.RM/      200104          11
  /MCMC.RM/      200115           3
  /OPES.FO/      200120           1
  /OPEN.FO/      200121           7
  OPEN.RM        200130         231  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /TERM.RM/      200361           1
  /PUT.FO/       200362           7
  PUT.SQ         200371        1360  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  WAR.SQ         201751         260  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /CLSF.FO/      202231           7
  CLSF.RM        202240          23  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /GET.BT/       202263           5
  BTRT.SQ        202270         114  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  WEOR.SQ        202404         142  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /SKFL.FO/      202546           7
  SKFL.SQ        202555          47  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  ERR.RM         202624         404  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  CHWR.SQ        203230           7  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  OSUB.RM        203237          65  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  OPEN.SQ        203324         262  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  OPEX.SQ        203606          14  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /PUT.RT/       203622          11
  RLEQ.RM        203633          42  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  CLSF.SQ        203675         131  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /CLSV.FO/      204026           7
  CLSV.SQ        204035         123  SL-SYSIO    06/16/76 COMPASS  3. 2-410
  /REW.FO/       204160           7
  REW.SQ         204167          31  SL-SYSIO    06/16/76 COMPASS  3. 2-410
```

```
LOAD MAP - VORLAX                                         CYBER LOADER 1.0-410      10/04/76  10.19.53.      PAGE

/GET.FO/     204220        7
/GET.RT/     204227       11
GET.SQ       204240     1041  SL-SYSIO   06/16/76 COMPASS  3. 2-410
Z.SQ         205301      101  SL-SYSIO   06/16/76 COMPASS  3. 2-410
W.SQ         205402       50  SL-SYSIO   06/16/76 COMPASS  3. 2-410
FSU.SQ       205452      106  SL-SYSIO   06/16/76 COMPASS  3. 2-410
 //          205560       16


     .615 CP SECONDS           221700B CM STORAGE USED                  345 TABLE MOVES
```

```
********** INPUT DECK **********

NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING
 0         0         1                  .10      -0.00      -0.00      1.00        99

 1              .151

 4             0.000      4.000      8.000     12.000

 1             5.000      0.000      0.000      0.000      1.000

 1            598.00     9.0500    31.6000    17.2500    68.0000

**********  1 **********
   24.4000    0.0000   18.9500   14.1000             ASYM WING PANEL  A3C
   85.8500   34.0000   18.9500    3.5000                          A3C
   10.0000    5.0000    1.0000    0.0000
    -.0566     .0668 0         0         2         -0        -0

-0        -0        -0

********* END OF INPUT DECK **********
```

```
NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING


PANEL GEOMETRY

 I  XAPEX(I)  YAPEX(I)  ZAPEX(I)    PDL(I)  LESWP(I) CSTART(I)  TAPER(I)  PSPAN(I)  NVOR(I)  RNCV(I)   SPC(I)

 1   24.4000    0.0000   10.9500    0.0000   61.0445   14.1000     .2482   34.0000     10.       5.      1.00

INCIDENCE AND CAMBER SLOPE INPUT FOR PANEL    1

    -.0566     .0669
    0.0000    0.0000    0.0000    0.0000    0.0000
    0.0000    0.0000    0.0000    0.0000    0.0000
```

```
NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =    .151

ALPHA =  0.000 DEG.
PSI =  5.000 DEG.

PITCH RATE =    0.00 DEG /SEC
ROLL RATE =    0.00 DEG /SEC
YAW RATE =    0.00 DEG /SEC


ANALYSIS (DIRECT) CASE    (INVERS = 0)


MOMENT AND ROTATION CENTER  S   XBAR =    .31600E+02     ZBAR =    .17250E+02  ***** VINF =    .10000E+01

CONFIGURATION IS OUT OF GROUND EFFECT


VORTEX WAKE FLOATATION PARAMETERS S  FLOATX =-0.00     FLOATY = 1.00



CN REFERENCED TO SURF+  CL.CY.CD.CT.CS REFERENCED TO SREF+  CM REFERENCED TO SREF*CBAR+  CRM.CYM REFERENCED TO SREF*WSPAN

   I   SURF/SREF        CN(I)        CL(I)        CY(I)        CD(I)        CT(I)        CS(I)          CM(I)        CRM(I)       CYM(I)

   1   .5003E+00       .08692       .04352      -.00001       .00006       .00179       .00370      -.6875E-01    .5441E-02    .4313E-04
** 1   .5003E+00       .10819       .05415      -.00006       .00065       .00176       .00363      -.6840E-01   -.9337E-02    .4484E-04

     SREF          WSPAN          CBAR              CLTOT          CDTOT          CYTOT     CMTOT          CRMTOT         CYMTOT

   .59800E+03    .68000E+02    .98500E+01         .09768         .00071        -.00006   -.13714E+00   -.38959E-02    .87966E-04


CD/CL**2 =   .0748    E =   .5502
```

```
NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =   .151     ALPHA =  0.000 DG    PSI =  5.000 DG    PITCH RATE =  0.00 D/S    ROLL RATE =  0.00 D/S    YAW RATE =  0.00 D/S

 S  C  X/C       X        Y         Z      CHORD   SLOPE  ITS     DCP      CNC     CN      DL       CMT         GAMMA        CTC       CDC



                               PANEL NO.   1                    ASYM WING PANEL  A3C

 1  1  .0245   27.805    1.700   18.950   13.570  -.0550  0      .325    1.339   .099    0.00    -.0052    .1939E+00    .04001    .03345
 1  2  .2061   30.269    1.700   18.950   13.570  -.0550  0      .117                                     .6857E-01
 1  3  .5000   34.257    1.700   18.950   13.570  -.0550  0      .076                                     .4330E-01
 1  4  .7939   38.246    1.700   18.950   13.570  -.0550  0      .046                                     .2540E-01
 1  5  .9755   40.710    1.700   18.950   13.570  -.0550  0      .017                                     .8231E-02

 2  1  .0245   33.924    5.100   18.950   12.510  -.0514  0      .396    1.337   .107    0.00    -.0024    .2361E+00    .05590    .01276
 2  2  .2061   36.196    5.100   18.950   12.510  -.0514  0      .131                                     .7698E-01
 2  3  .5000   39.872    5.100   18.950   12.510  -.0514  0      .074                                     .4169E-01
 2  4  .7939   43.549    5.100   18.950   12.510  -.0514  0      .041                                     .2199E-01
 2  5  .9755   45.821    5.100   18.950   12.510  -.0514  0      .015                                     .6966E-02

 3  1  .0245   40.043    8.500   18.950   11.450  -.0472  0      .422    1.266   .111    0.00    -.0017    .2515E+00    .05834    .00136
 3  2  .2061   42.122    8.500   18.950   11.450  -.0472  0      .137                                     .8003E-01
 3  3  .5000   45.487    8.500   18.950   11.450  -.0472  0      .073                                     .4156E-01
 3  4  .7939   48.853    8.500   18.950   11.450  -.0472  0      .040                                     .2164E-01
 3  5  .9755   50.932    8.500   18.950   11.450  -.0472  0      .015                                     .6931E-02

 4  1  .0245   46.162   11.900   18.950   10.390  -.0421  0      .423    1.144   .110    0.00    -.0015    .2522E+00    .05331   -.00516
 4  2  .2061   48.049   11.900   18.950   10.390  -.0421  0      .136                                     .7986E-01
 4  3  .5000   51.102   11.900   18.950   10.390  -.0421  0      .072                                     .4102E-01
 4  4  .7939   54.156   11.900   18.950   10.390  -.0421  0      .040                                     .2136E-01
 4  5  .9755   56.043   11.900   18.950   10.390  -.0421  0      .015                                     .6862E-02

 5  1  .0245   52.281   15.300   18.950    9.330  -.0358  0      .406     .985   .106    0.00    -.0014    .2419E+00    .04402   -.00877
 5  2  .2061   53.975   15.300   18.950    9.330  -.0358  0      .131                                     .7659E-01
 5  3  .5000   56.717   15.300   18.950    9.330  -.0358  0      .069                                     .3921E-01
 5  4  .7939   59.460   15.300   18.950    9.330  -.0358  0      .038                                     .2041E-01
 5  5  .9755   61.154   15.300   18.950    9.330  -.0358  0      .015                                     .6561E-02

 6  1  .0245   58.400   18.700   18.950    8.270  -.0279  0      .369     .793   .096    0.00    -.0013    .2197E+00    .03217   -.01001
 6  2  .2061   59.902   18.700   18.950    8.270  -.0279  0      .119                                     .6971E-01
 6  3  .5000   62.332   18.700   18.950    8.270  -.0279  0      .063                                     .3569E-01
 6  4  .7939   64.763   18.700   18.950    8.270  -.0279  0      .035                                     .1852E-01
 6  5  .9755   66.265   18.700   18.950    8.270  -.0279  0      .013                                     .5944E-02

 7  1  .0245   64.519   22.100   18.950    7.210  -.0177  0      .306     .575   .080    0.00    -.0011    .1824E+00    .01931   -.00911
 7  2  .2061   65.829   22.100   18.950    7.210  -.0177  0      .099                                     .5805E-01
 7  3  .5000   67.947   22.100   18.950    7.210  -.0177  0      .053                                     .2974E-01
 7  4  .7939   70.066   22.100   18.950    7.210  -.0177  0      .029                                     .1537E-01
 7  5  .9755   71.376   22.100   18.950    7.210  -.0177  0      .011                                     .4913E-02

 8  1  .0245   70.638   25.500   18.950    6.150  -.0039  0      .207     .334   .054    0.00    -.0008    .1235E+00    .00753   -.00620
 8  2  .2061   71.755   25.500   18.950    6.150  -.0039  0      .067                                     .3950E-01
 8  3  .5000   73.562   25.500   18.950    6.150  -.0039  0      .036                                     .2041E-01
 8  4  .7939   75.370   25.500   18.950    6.150  -.0039  0      .019                                     .1042E-01
 8  5  .9755   76.487   25.500   18.950    6.150  -.0039  0      .007                                     .3304E-02

 9  1  .0245   76.757   28.900   18.950    5.090   .0155  0      .051     .071   .014    0.00    -.0001    .3064E-01    .00038   -.00148
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NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =    .151     ALPHA =  0.000 DG     PSI =  5.000 DG     PITCH RATE =  0.00 D/S     ROLL RATE =  0.00 D/S     YAW RATE =  0.00 D/S

  S  C  X/C       X        Y        Z      CHORD    SLOPE  ITS     DCP      CNC      CN      UL       CMT         GAMMA        CTC      CDC


  9  2  .2061   77.682   28.900   18.950   5.090    .0155   0      .018                                        .1034E-01
  9  3  .5000   79.177   28.900   18.950   5.090    .0155   0      .010                                        .5542E-02
  9  4  .7939   80.673   28.900   18.950   5.090    .0155   0      .005                                        .2736E-02
  9  5  .9755   81.598   28.900   18.950   5.090    .0155   0      .002                                        .8462E-03

 10  1  .0245   82.876   32.300   18.950   4.030    .0452   0     -.196    -.194   -.048    0.00    -.0002    -.1171E+00    .00450   .00426
 10  2  .2061   83.608   32.300   18.950   4.030    .0452   0     -.061                                       -.3556E-01
 10  3  .5000   84.792   32.300   18.950   4.030    .0452   0     -.030                                       -.1700E-01
 10  4  .7939   85.977   32.300   18.950   4.030    .0452   0     -.015                                       -.7691E-02
 10  5  .9755   86.709   32.300   18.950   4.030    .0452   0     -.005                                       -.2147E-02

 11  1  .0245   27.805   -1.700   18.950  13.570   -.0550   0      .448    1.749    .129    0.00    -.0047     .1939E+00    .04003   .05[illegible]40
 11  2  .2061   30.269   -1.700   18.950  13.570   -.0550   0      .156                                        .6858E-01
 11  3  .5000   34.257   -1.700   18.950  13.570   -.0550   0      .097                                        .4330E-01
 11  4  .7939   38.246   -1.700   18.950  13.570   -.0550   0      .055                                        .2538E-01
 11  5  .9755   40.710   -1.700   18.950  13.570   -.0550   0      .016                                        .8224E-02

 12  1  .0245   33.924   -5.100   18.950  12.510   -.0514   0      .545    1.744    .139    0.00    -.0006     .2360E+00    .05587   .03361
 12  2  .2061   36.196   -5.100   18.950  12.510   -.0514   0      .175                                        7691E-01
 12  3  .5000   39.872   -5.100   18.950  12.510   -.0514   0      .092                                        .4159E-01
 12  4  .7939   43.549   -5.100   18.950  12.510   -.0514   0      .046                                        .2182E-01
 12  5  .9755   45.821   -5.100   18.950  12.510   -.0514   0      .012                                        .6867E-02

 13  1  .0245   40.043   -8.500   18.950  11.450   -.0472   0      .574    1.639    .143    0.00     .0007     .2510E+00    .05813   .01908
 13  2  .2061   42.122   -8.500   18.950  11.450   -.0472   0      .181                                        .7971E-01
 13  3  .5000   45.487   -8.500   18.950  11.450   -.0472   0      .091                                        .4103E-01
 13  4  .7939   48.853   -8.500   18.950  11.450   -.0472   0      .044                                        .2073E-01
 13  5  .9755   50.932   -8.500   18.950  11.450   -.0472   0      .011                                        .6380E-02

 14  1  .0245   46.162  -11.900   18.950  10.390   -.0421   0      .578    1.464    .141    0.00     .0013     .2506E+00    .05266   .00887
 14  2  .2061   48.049  -11.900   18.950  10.390   -.0421   0      .180                                        .7892E-01
 14  3  .5000   51.102  -11.900   18.950  10.390   -.0421   0      .088                                        .3977E-01
 14  4  .7939   54.156  -11.900   18.950  10.390   -.0421   0      .041                                        .1959E-01
 14  5  .9755   56.043  -11.900   18.950  10.390   -.0421   0      .010                                        .5933E-02

 15  1  .0245   52.281  -15.300   18.950   9.330   -.0358   0      .549    1.239    .133    0.00     .0017     .2381E+00    .04271   .00160
 15  2  .2061   53.975  -15.300   18.950   9.330   -.0358   0      .170                                        .7472E-01
 15  3  .5000   56.717  -15.300   18.950   9.330   -.0358   0      .082                                        .3713E-01
 15  4  .7939   59.460  -15.300   18.950   9.330   -.0358   0      .038                                        .1787E-01
 15  5  .9755   61.154  -15.300   18.950   9.330   -.0358   0      .069                                        .5338E-02

 16  1  .0245   58.400  -18.700   18.950   8.270   -.0279   0      .491     .974    .118    0.00     .0018     .2127E+00    .03024  -.00307
 16  2  .2061   59.902  -18.700   18.950   8.270   -.0279   0      .152                                        .6661E-01
 16  3  .5000   62.332  -18.700   18.950   8.270   -.0279   0      .072                                        .3269E-01
 16  4  .7939   64.763  -18.700   18.950   8.270   -.0279   0      .032                                        .1532E-01
 16  5  .9755   66.265  -18.700   18.950   8.270   -.0279   0      .007                                        .4498E-02

 17  1  .0245   64.519  -22.100   18.950   7.210   -.0177   0      .395     .677    .094    0.00     .0018     .1714E+00    .01713  -.00514
 17  2  .2061   65.829  -22.100   18.950   7.210   -.0177   0      .122                                        .5348E-01
 17  3  .5000   67.947  -22.100   18.950   7.210   -.0177   0      .057                                        .2581E-01
 17  4  .7939   70.066  -22.100   18.950   7.210   -.0177   0      .024                                        .1160E-01
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NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =   .151    ALPHA =  0.000 DG    PSI =  5.000 DG    PITCH RATE =  0.00 D/S    ROLL RATE =  0.00 D/S    YAW RATE =  0.00 D/S

 S  C  X/C       X        Y         Z       CHORD    SLOPE  ITS      DCP       CNC      CN       DL       CMT          GAMMA       CTC      CDC


 17  5  .9755  71.376 -22.100  18.950   7.210  -.0177  0     .005                                             .3300E-02

 18  1  .0245  70.638 -25.500  18.950   6.150  -.0039  0     .249      .354    .057    0.00     .0017     .1077E+00   .00578  -.00437
 18  2  .2061  71.755 -25.500  18.950   6.150  -.0039  0     .076                                             .3328E-01
 18  3  .5000  73.562 -25.500  18.950   6.150  -.0039  0     .034                                             .1537E-01
 18  4  .7939  75.370 -25.500  18.950   6.150  -.0039  0     .013                                             .6156E-02
 18  5  .9755  76.487 -25.500  18.950   6.150  -.0039  0     .002                                             .1575E-02

 19  1  .0245  76.757 -28.900  18.950   5.090   .0155  0     .022      .009    .002    0.00     .0014     .9486E-02   .00004  -.00018
 19  2  .2061  77.682 -28.900  18.950   5.090   .0155  0     .005                                             .2280E-02
 19  3  .5000  79.177 -28.900  18.950   5.090   .0155  0    -.001                                            -.5112E-03
 19  4  .7939  80.673 -28.900  18.950   5.090   .0155  0    -.004                                            -.1859E-02
 19  5  .9755  81.598 -28.900  18.950   5.090   .0155  0    -.002                                            -.9290E-03

 20  1  .0245  82.876 -32.300  18.950   4.030   .0452  0    -.329     -.328   -.081    0.00    -.0003    -.1428E+00   .00665   .00815
 20  2  .2061  83.608 -32.300  18.950   4.030   .0452  0    -.102                                            -.4501E-01
 20  3  .5000  84.792 -32.300  18.950   4.030   .0452  0    -.052                                            -.2343E-01
 20  4  .7939  85.977 -32.300  18.950   4.030   .0452  0    -.025                                            -.1199E-01
 20  5  .9755  86.709 -32.300  18.950   4.030   .0452  0    -.006                                            -.3695E-02
ITRMAX = 99

EPS =    .00047

ITER =  9

RIG =    .00043

CONVERGENCE FACTOR =    .40424

END OF CASE
```

ALPHA = 4.0°

OUTPUT DATA

DELETED HERE

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NASA VORLAX CHECKOUT FOR CDC USING SJ FLYING WING

MACH =   .151

ALPHA =  0.000 DEG.
PSI =  5.000 DEG.

PITCH RATE =   0.00 DEG /SEC
ROLL RATE =   0.00 DEG /SEC
YAW RATE =   0.00 DEG /SEC



ANALYSIS (DIRECT) CASE    (INVERS = 0)



MOMENT AND ROTATION CENTER  <   XBAR =   .31600E+02     ZBAR =   .17250E+02  ***** VINF =   .10000E+01

CONFIGURATION IS OUT OF GROUND EFFECT


VORTEX WAKE FLOATATION PARAMETERS S  FLOATX =-0.00     FLOATY = 1.00



CN REFERENCED TO SURF,  CL,CY,CD,CT,CS REFERENCED TO SREF,  CM REFFRENCED TO SREF*CBAR,  CRM,CYN REFERENCED TO SREF*WSPAN

   I   SURF/SREF        CN(I)        CL(I)        CY(I)        CD(I)        CT(I)        CS(I)          CM(I)        CRM(I)        CYN(I)

   1   .5003E+00       .42751       .21700       .00268      -.00041       .03742       .07730     -.4882E+00     .3750E-01     .2440E-02
** 1   .5003E+00       .54741       .27594       .00242       .01090       .03647       .07532     -.5391E+00    -.6628E-01     .2209E-02

      SREF         WSPAN         CBAR              CLTOT          CDTOT          CYTOT     CMTOT         CRMTOT         CYNTOT

   .59800E+03    .68000E+02    .98500E+01         .49294         .01049         .00509   -.10273E+01   -.28773E-01    .46488E-02


CD/CL**2 =  .0432    E =  .9537
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NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =   .151    ALPHA =  8.000 DG    PSI =  5.000 DG    PITCH RATE =  0.00 D/S    ROLL RATE =  0.00 D/S    YAW RATE =  0.00 D/S

  S  C  X/C       X        Y         Z      CHORD    SLOPE  ITS      DCP       CNC      CN       DL      CMT          GAMMA        CTC       CDC


                                     PANEL NO.   1                ASYM WING PANEL  A3C

  1  1  .0245  27.805    1.700    18.950   13.570   -.0550  0     1.155     4.827    .356     0.00    -.0200    .6955E+00    .51394    .43009
  1  2  .2061  30.269    1.700    18.950   13.570   -.0550  0      .420                                         .2485E+00
  1  3  .5000  34.257    1.700    18.950   13.570   -.0550  0      .277                                         .1596E+00
  1  4  .7939  38.246    1.700    18.950   13.570   -.0550  0      .172                                         .9497E-01
  1  5  .9755  40.710    1.700    18.950   13.570   -.0550  0      .064                                         .3099E-01

  2  1  .0245  33.924    5.100    18.950   12.510   -.0514  0     1.450     4.944    .395     0.00    -.0099    .8730E+00    .76362    .19072
  2  2  .2061  36.196    5.100    18.950   12.510   -.0514  0      .484                                         .2863E+00
  2  3  .5000  39.872    5.100    18.950   12.510   -.0514  0      .275                                         .1577E+00
  2  4  .7939  43.549    5.100    18.950   12.510   -.0514  0      .155                                         .8408E-01
  2  5  .9755  45.821    5.100    18.950   12.510   -.0514  0      .058                                         .2663E-01

  3  1  .0245  40.043    8.500    18.950   11.450   -.0472  0     1.608     4.867    .425     0.00    -.0076    .9680E+00    .86409    .05710
  3  2  .2061  42.122    8.500    18.950   11.450   -.0472  0      .523                                         .3095E+00
  3  3  .5000  45.487    8.500    18.950   11.450   -.0472  0      .286                                         .1634E+00
  3  4  .7939  48.853    8.500    18.950   11.450   -.0472  0      .159                                         .8604E-01
  3  5  .9755  50.932    8.500    18.950   11.450   -.0472  0      .060                                         .2741E-01

  4  1  .0245  46.162   11.900    18.950   10.390   -.0421  0     1.705     4.649    .447     0.00    -.0072    .1026E+01    .88215   -.02522
  4  2  .2061  48.049   11.900    18.950   10.390   -.0421  0      .551                                         .3260E+00
  4  3  .5000  51.102   11.900    18.950   10.390   -.0421  0      .298                                         .1704E+00
  4  4  .7939  54.156   11.900    18.950   10.390   -.0421  0      .165                                         .8953E-01
  4  5  .9755  56.043   11.900    18.950   10.390   -.0421  0      .063                                         .2862E-01

  5  1  .0245  52.281   15.300    18.950    9.330   -.0358  0     1.767     4.322    .463     0.00    -.0073    .1064E+01    .85127   -.08143
  5  2  .2061  53.975   15.300    18.950    9.330   -.0358  0      .571                                         .3377E+00
  5  3  .5000  56.717   15.300    18.950    9.330   -.0358  0      .308                                         .1761E+00
  5  4  .7939  59.460   15.300    18.950    9.330   -.0358  0      .171                                         .9250E-01
  5  5  .9755  61.154   15.300    18.950    9.330   -.0358  0      .065                                         .2959E-01

  6  1  .0245  58.400   18.700    18.950    8.270   -.0279  0     1.802     3.909    .473     0.00    -.0076    .1084E+01    .78418   -.11895
  6  2  .2061  59.902   18.700    18.950    8.270   -.0279  0      .583                                         .3447E+00
  6  3  .5000  62.332   18.700    18.950    8.270   -.0279  0      .315                                         .1798E+00
  6  4  .7939  64.763   18.700    18.950    8.270   -.0279  0      .174                                         .9443E-01
  6  5  .9755  66.265   18.700    18.950    8.270   -.0279  0      .066                                         .3019E-01

  7  1  .0245  64.519   22.100    18.950    7.210   -.0177  0     1.806     3.423    .475     0.00    -.0078    .1087E+01    .68687   -.13988
  7  2  .2061  65.829   22.100    18.950    7.210   -.0177  0      .585                                         .3461E+00
  7  3  .5000  67.947   22.100    18.950    7.210   -.0177  0      .317                                         .1811E+00
  7  4  .7939  70.066   22.100    18.950    7.210   -.0177  0      .176                                         .9503E-01
  7  5  .9755  71.376   22.100    18.950    7.210   -.0177  0      .067                                         .3031E-01

  8  1  .0245  70.638   25.500    18.950    6.150   -.0039  0     1.772     2.871    .467     0.00    -.0079    .1067E+01    .56385   -.14527
  8  2  .2061  71.755   25.500    18.950    6.150   -.0039  0      .575                                         .3399E+00
  8  3  .5000  73.562   25.500    18.950    6.150   -.0039  0      .313                                         .1788E+00
  8  4  .7939  75.370   25.500    18.950    6.150   -.0039  0      .173                                         .9384E-01
  8  5  .9755  76.487   25.500    18.950    6.150   -.0039  0      .066                                         .2984E-01

  9  1  .0245  76.757   28.900    18.950    5.090    .0155  0     1.679     2.256    .443     0.00    -.0078    .1010E+01    .41858   -.13442
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NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =    .151    ALPHA =  8.000 DG    PSI =  5.000 DG    PITCH RATE =  0.00 D/S    ROLL RATE =  0.00 D/S    YAW RATE =  0.00 D/S

  S  C  X/C      X        Y         Z      CHORD    SLOPE  ITS     DCP       CNC     CN      DL       CMT        GAMMA       CTC      CDC


  9  2  .2061  77.682  28.900   18.950   5.090    .0155  0      .545                                         .3224E+00
  9  3  .5000  79.177  28.900   18.950   5.090    .0155  0      .258                                         .1704E+00
  9  4  .7939  80.673  28.900   18.950   5.090    .0155  0      .165                                         .8946E-01
  9  5  .9755  81.598  28.900   18.950   5.090    .0155  0      .062                                         .2835E-01

 10  1  .0245  82.876  32.300   18.950   4.030    .0452  0     1.467     1.553   .385    0.00    -.0060     .8832E+00    .25344  -.10463
 10  2  .2061  83.608  32.300   18.950   4.030    .0452  0      .476                                         .2815E+00
 10  3  .5000  84.792  32.300   18.950   4.030    .0452  0      .258                                         .1476E+00
 10  4  .7939  85.977  32.300   18.950   4.030    .0452  0      .141                                         .7594E-01
 10  5  .9755  86.709  32.300   18.950   4.030    .0452  0      .052                                         .2353E-01

 11  1  .0245  27.805  -1.700   18.950  13.570   -.0550  0     1.590     6.312   .465    0.00    -.0189     .6957E+00    .51419   .71657
 11  2  .2061  30.269  -1.700   18.950  13.570   -.0550  0      .561                                         .2484E+00
 11  3  .5000  34.257  -1.700   18.950  13.570   -.0550  0      .353                                         .1598E+00
 11  4  .7939  38.246  -1.700   18.950  13.570   -.0550  0      .203                                         .9506E-01
 11  5  .9755  40.710  -1.700   18.950  13.570   -.0550  0      .058                                         .3106E-01

 12  1  .0245  33.924  -5.100   18.950  12.510   -.0514  0     1.995     6.471   .517    0.00    -.0036     .8730E+00    .76369   .48036
 12  2  .2061  36.196  -5.100   18.950  12.510   -.0514  0      .646                                         .2864E+00
 12  3  .5000  39.872  -5.100   18.950  12.510   -.0514  0      .348                                         .1579E+00
 12  4  .7939  43.549  -5.100   18.950  12.510   -.0514  0      .179                                         .8490E-01
 12  5  .9755  45.821  -5.100   18.950  12.510   -.0514  0      .048                                         .2718E-01

 13  1  .0245  40.043  -8.500   18.950  11.450   -.0472  0     2.212     6.350   .555    0.00     .0001     .9680E+00    .86396   .33222
 13  2  .2061  42.122  -8.500   18.950  11.450   -.0472  0      .698                                         .3094E+00
 13  3  .5000  45.487  -8.500   18.950  11.450   -.0472  0      .358                                         .1630E+00
 13  4  .7939  48.853  -8.500   18.950  11.450   -.0472  0      .179                                         .8509E-01
 13  5  .9755  50.932  -8.500   18.950  11.450   -.0472  0      .047                                         .2680E-01

 14  1  .0245  46.162 -11.900   18.950  10.390   -.0421  0     2.341     6.028   .580    0.00     .0021     .1024E+01    .87928   .22659
 14  2  .2061  48.049 -11.900   18.950  10.390   -.0421  0      .733                                         .3248E+00
 14  3  .5000  51.102 -11.900   18.950  10.390   -.0421  0      .370                                         .1684E+00
 14  4  .7939  54.156 -11.900   18.950  10.390   -.0421  0      .181                                         .8650E-01
 14  5  .9755  56.043 -11.900   18.950  10.390   -.0421  0      .046                                         .2698E-01

 15  1  .0245  52.281 -15.300   18.950   9.330   -.0358  0     2.416     5.562   .596    0.00     .0031     .1057E+01    .84176   .14307
 15  2  .2061  53.975 -15.300   18.950   9.330   -.0358  0      .755                                         .3346E+00
 15  3  .5000  56.717 -15.300   18.950   9.330   -.0358  0      .378                                         .1721E+00
 15  4  .7939  59.460 -15.300   18.950   9.330   -.0358  0      .183                                         .8743E-01
 15  5  .9755  61.154 -15.300   18.950   9.330   -.0358  0      .046                                         .2712E-01

 16  1  .0245  58.400 -18.700   18.950   8.270   -.0279  0     2.447     4.983   .603    0.00     .0036     .1071E+01    .76570   .07812
 16  2  .2061  59.902 -18.700   18.950   8.270   -.0279  0      .764                                         .3387E+00
 16  3  .5000  62.332 -18.700   18.950   8.270   -.0279  0      .381                                         .1737E+00
 16  4  .7939  64.763 -18.700   18.950   8.270   -.0279  0      .183                                         .8761E-01
 16  5  .9755  66.265 -18.700   18.950   8.270   -.0279  0      .046                                         .2707E-01

 17  1  .0245  64.519 -22.100   18.950   7.210   -.0177  0     2.433     4.314   .598    0.00     .0037     .1064E+01    .65947   .02062
 17  2  .2061  65.829 -22.100   18.950   7.210   -.0177  0      .759                                         .3364E+00
 17  3  .5000  67.947 -22.100   18.950   7.210   -.0177  0      .379                                         .1725E+00
 17  4  .7939  70.066 -22.100   18.950   7.210   -.0177  0      .181                                         .866
```

```
NASA VORLAX CHECKOUT FOR CDC USING S3 FLYING WING

MACH =   .151    ALPHA =  8.000 DG    PSI =  5.000 DG    PITCH RATE =  0.00 D/S    ROLL RATE =  0.00 D/S    YAW RATE =  0.00 D/S

  S  C  X/C       X       Y        Z      CHORD   SLOPE  ITS      DCP      CNC      CN       DL       CMT        GAMMA       CTC      CDC


 17  5  .9755  71.376 -22.100  18.950   7.210  -.0177   0      .045                                          .2671E-01

 18  1  .0245  70.638 -25.500  18.950   6.150  -.0039   0     2.354     3.568    .580     0.00     .0036     .1032E+01    .52883  -.01101
 18  2  .2061  71.755 -25.500  18.950   6.150  -.0039   0      .735                                          .3260E+00
 18  3  .5000  73.562 -25.500  18.950   6.150  -.0039   0      .367                                          .1673E+00
 18  4  .7939  75.370 -25.500  18.950   6.150  -.0039   0      .176                                          .8399E-01
 18  5  .9755  76.487 -25.500  18.950   6.150  -.0039   0      .044                                          .2585E-01

 19  1  .0245  76.757 -28.900  18.950   5.090   .0155   0     2.196     2.750    .540     0.00     .0033     .9611E+00    .37960  -.03464
 19  2  .2061  77.682 -28.900  18.950   5.090   .0155   0      .684                                          .3035E+00
 19  3  .5000  79.177 -28.900  18.950   5.090   .0155   0      .343                                          .1560E+00
 19  4  .7939  80.673 -28.900  18.950   5.090   .0155   0      .164                                          .7835E-01
 19  5  .9755  81.598 -28.900  18.950   5.090   .0155   0      .041                                          .2403E-01

 20  1  .0245  82.876 -32.300  18.950   4.030   .0452   0     1.865     1.833    .455     0.00     .0042     .8163E+00    .21719  -.04219
 20  2  .2061  83.608 -32.300  18.950   4.030   .0452   0      .579                                          .2566E+00
 20  3  .5000  84.792 -32.300  18.950   4.030   .0452   0      .286                                          .1302E+00
 20  4  .7939  85.977 -32.300  18.950   4.030   .0452   0      .133                                          .6393E-01
 20  5  .9755  86.709 -32.300  18.950   4.030   .0452   0      .032                                          .1907E-01
ITRMAX = 99

EPS =     .00231

ITER =  9

BIG =     .00145

CONVERGENCE FACTOR =     .48035

END OF CASE
```

ALPHA = 12°

OUTPUT DATA

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# APPENDIX C

## WAVE DRAG TO VORLAX INPUT CONVERSION PROGRAM

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## SUMMARY

The purpose of a program called WDTVOR, developed to convert the Wave Drag input geometry into the VORLAX input geometry description, is to save time, improve accuracy, and reduce human drudgery when configurations for which the geometry was first digitized in the Wave Drag format are also to be analyzed on the VORLAX program.

The present version of WDTVOR contains the option to convert fuselages to flat plates having the correct planform area or to a simulation having hexagonal cross sections. All wings and planer surfaces are converted to zero thickness panels although the wing camber effects are preserved. Engine pods are converted as curved panels approximated by hexagons.

## INTRODUCTION

In the analysis of an airplane design, what is basically the same geometric body is described by several different geometric models, each of which is unique to the discipline for which it is designed; yet at the same time there exist certain elements common to all models. For example, the NASA Wave Drag format (Reference 12) emphasizes the enclosed volume of the aircraft and correct spatial relationship of components while the VORLAX method of aerodynamic analysis (unified subsonic and supersonic) uses a paneling procedure similar to but different in detail from the NASA Wave Drag format in order to reduce computation time.

The program described herein, called WDTVOR, is for direct transformation from WAVE DRAG to VORLAX input format. A comparison program, called VORTWD, transforms data from VORLAX to WAVE DRAG formats and is documented in Appendix D.

Presently the simulation form into which Wave Drag data is converted is limited to that most commonly used in VORLAX analysis as follows:

### GENERAL

Cosine law spacing of streamwise vortices and equal interval spacing of lateral vortices is assumed.

A single Mach number from the first wave drag case card is picked up and output in the VORLAX dataset. Three angles-of-attack, 0, 5, and 10 are also included.

Symmetric Flight is assumed.

The value of CBAR is arbitrarily set to 1.0. The moment center coordinates, XBAR and ZBAR, are set to zero.

All major planar panels are set up for three spanwise vortices (NV0R = 3) and 10 chordwise vortices (RNCV = 10). Full leading edge suction is assumed on each panel (SPC = 1.0) except for the fuselage panel.

## WINGS

- Wing camber is preserved in the transformation.
- Wing thickness is not preserved. Converted wing panels are zero thickness.

## FUSELAGE

- Both circular and noncircular cross section fuselages may be converted to a single zero thickness panel of trapezoidal shape. The planform area of the zero thickness fuselage is made equivalent to the planform area of the Wave Drag simulation and the vertical location of the fuselage is set equal to that of the leading edge of the wing root chord so as to effectively "seal" the wing-fuselage juncture in the VORLAX simulation.
- Optionally fuselages which are circular in the Wave Drag simulation may be transformed to a hexagonal cross-section simulation in VORLAX. With this option transverse vortices are located on the actual body surface. Also a wing-fuselage seal is assured by holding the fuselage diameter constant in the region from leading to trailing edge of the first wing chord and by assuming that one vortex of the reference polygon lies in the plane of the first wing chord.
- If the Wave Drag simulation was a cambered circular one, the fuselage camber is preserved in the VORLAX simulation.
- If the fuselage was of abritrary cross section in Wave Drag no camber information is transferred to VORLAX. At present it is possible to convert arbitrary fuselages into only the zero thickness planform simulation in VORLAX.

## NACELLES

- Circular nacelles are transformed as closed hexagonal panels using the option that transverse vortices are located on the actual body surface.

FINS

- Each fin is treated as a single panel of zero thickness.

CANARDS

- Each canard is treated as a single panel of zero thickness.

After a Wave Drag data set has been converted to VORLAX format it may be validated by converting it back into Wave Drag format and a configuration plot made. This plot will, of course, be different from a plot of the original Wave Drag dataset by virtue of the zero thickness panel representations.

## NOMENCLATURE

| | |
|---|---|
| CPU | Central Processor Unit. |
| FUSTYP | Flag for fuselage type. Use 0 for single trapezoidal panel fuselage simulation. Use 1 for hexagonal (curved) panel fuselage simulation. |
| VORLAX | A Unified Non-Planar Vortex Lattice Method for Subsonic and Supersonic Flow Described in this report. |
| WDTVOR | Wave Drag to VORLAX data conversion Program described in this appendix. |
| VORTWD | VORLAX to Wave Drag data conversion program described in Appendix D. |

## PROCEDURE

1. Prepare a dataset in WAVE DRAG format if it does not already exist. See Reference 12 for the WAVE DRAG input description. Be sure at least one case card is included with the dataset. It is necessary to instruct the conversion program as to whether the VORLAX simulation of the fuselage is to be a single trapezoidal panel or a curved (hexagonal) panel. This is accomplished by appending to the front of the WAVE DRAG dataset a card in namelist format specifying either FUSTYP = 0 for a single trapezoidal or FUSTYP = 1 for curved (hexagonal) simulation. Figure C-1 is a listing of an example WAVE DRAG dataset showing how the namelist input is placed at its beginning. Figure C-2 is a graphic representation of the Figure C-1 dataset obtained from the Configuration Plot Program of Reference 12.

2. Submit the dataset with the WDTVOR program. A compilation listing of the program is included at the end of this appendix.

3. Examine the output from the above submittal. Output consists of a listing of the input dataset in card image form (see Figure C-1) followed by a listing of the output dataset in the VORLAX format. Figures C-3 and C-8 are sample datasets as output from WDTVOR program. Figure C-3 was based on the curved (hexagonal) panel VORLAX fuselage simulation while Figure C-8 was derived from the single trapdzcidal panel fuselage.

4. Because of the simplification that takes place in WDTVOR, e.g., zero thickness panels, it may be desirable to generate a graphic representation of the VORLAX dataset. This is accomplished by using the VORLAX to WAVE DRAG conversion program described in Appendix B followed by the Configuration Plot Program described in Reference 12. Figure C-4 is a sample of a simplified dataset after transformation back into WAVE DRAG format. Figure C-5 is a plot of the Figure C-4 dataset. Figure C-6 is a listing of the WAVE DRAG format for the single trapezoidal panel fuselage simulation and Figure C-7 is the corresponding plot.

5. Generally, a certain amount of editing is required to prepare a VORLAX dataset generated by transformation via the WDTVOR program for an actual run on VORLAX. Figure C-8 is a listing of a converted dataset as output from the conversion program and Figure C-9 is the same dataset after it has been edited preparatory to a VORLAX run.

   An explanation of the notes of Figure C-9 follows:

   NOTE 1 - The value of the over relaxation parameter, REXPAR was changed from -0.02 to 0.0 implying that the program is to compute internally the optimum over relaxation value.

   NOTE 2 - The number of angles of attack, NALPHA, was reduced from 3 to 1 and the single ALPHA selected was 5.0 degrees.

   NOTE 3 - The number of major panels, NPAN, was changed from 12 to 13. The pitching moment reference length, CBAR, was changed from 1.0 to 1022.28. The XBAR and ZBAR of the moment reference point were changed from zero to 1910.4 and -800.4, respectively.

   NOTE 4 - The number of spanwise vortices, NVOR, and the number of chordwise vortices, RNCV, were adjusted to provide a better subpaneling representation.

   NOTE 5 - Wing Panel Number 5 was completely eliminated. It was actually a null panel having little or no span which was included in the original WAVE DRAG simulation for another purpose but which would have caused errors in VORLAX if it has been retained.

NOTE 6 - A vertical panel was added to simulate a nacelle pylon which was not included in the original WAVE DRAG simulation.

NOTE 7 - The spanwise location of the nacelle was moved outboard from 214. to 233.94 to coincide with a major panel break in the wing. Alternatives to this procedure would be to create an extra major panel having an edge at the 214. span location or making sure that one of the wing vortices resulting from subpaneling coincides precisely with the engine pylon spanwise location. The above precautions must be taken whenever major panels intersect.

NOTE 8 - The variable area nacelles were changed to fixed area ones by setting the ZCI values to 100. This makes each nacelle cross-section equal to that of the reference polygon, in this case the inlet area. This was a compromise made to simplify the nacelle pylon simulation. With constant area nacelles the pylon could be simulated by a single rectangular panel. Retention of the variable area nacelles would have required several panels to seal the pylon area between the wing and engine.

NOTE 9 - The location of the nacelle was moved outboard from 204. to 233.94, otherwise, Note 7 applies.

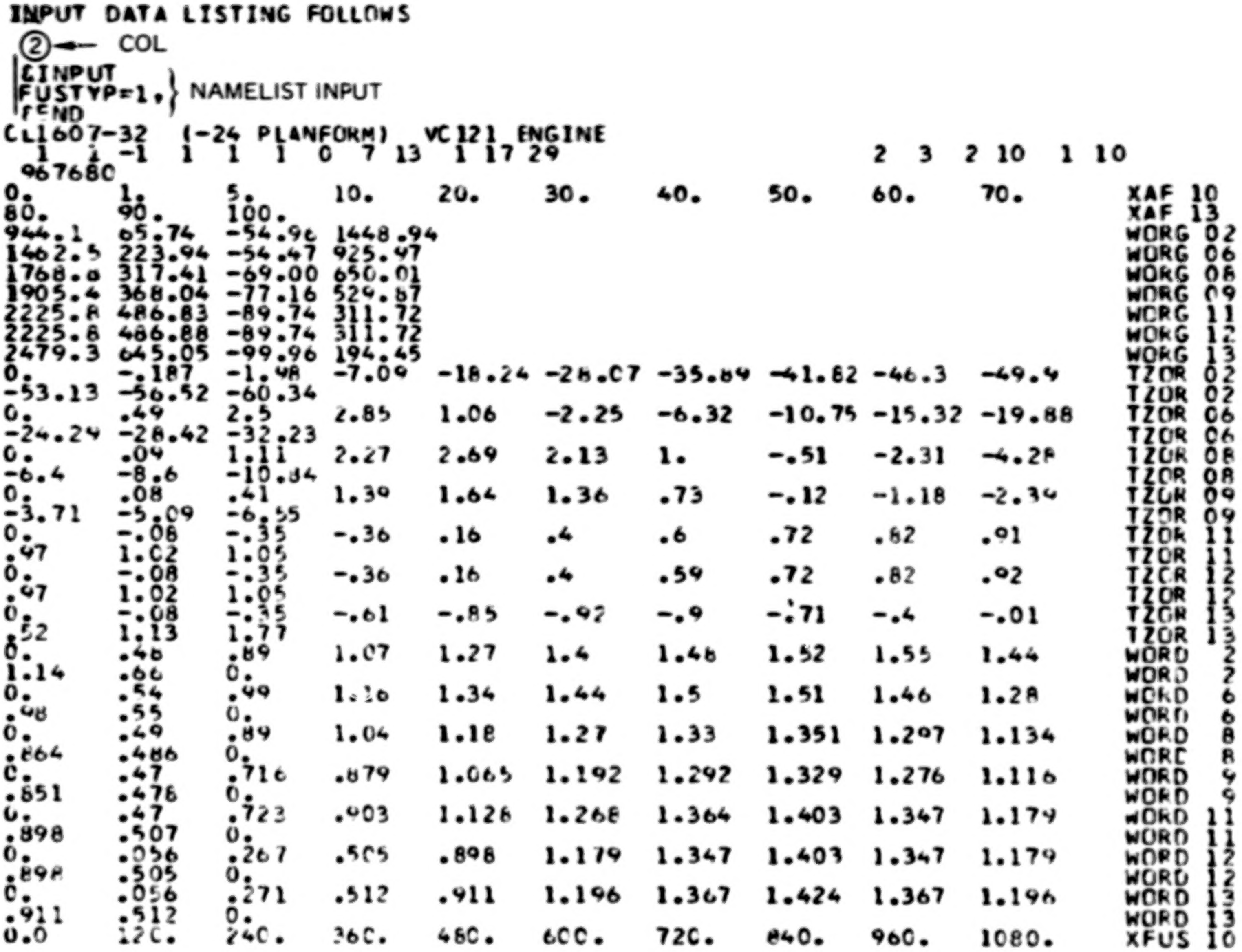
NOTE 10 - Fin Panel #2 which was on the aircraft centerline was completely eliminated. Since the desired VORLAX run was to be symmetric about the pitch plane the centerline fin was not required. Furthermore, its inclusion would have unnecessarily increased computing cost because its presence alone triggers off certain asymmetric calculations.

NOTE 11 - The horizontal tail (labeled canard) root chord dimensions were changed to coincide with the side of the fuselage. Actually, only that portion of the horizontal tail outboard of the VORLAX fuselage simulation is included.

NOTE 12 - A vertical panel was added to seal the gap between the plane of the horizontal tail (Z = -40.) and that of the fuselage (Z = 54.96).

6. It is a good idea to submit the edited dataset to the VORTWD program (Appendix D) to recheck the editing just done. This step is optional. It probably wouldn't be done if only minor editing was involved in Step 5. If major editing was done, such as the addition of pylons and sealer panels as in Figure C-9, then it is recommended. The results of converting and plotting the dataset of Figure C-9 is shown in Figure C-10. Note the absence of centerline fin, the addition of engine pylons and horizontal tail sealer panels and the constant diameter nacelle simulation.

7. The edited dataset may then be submitted to the VORLAX program. A portion of the VORLAX output resulting from this submittal is presented in Figure C-11.



```
INPUT DATA LISTING FOLLOWS
 ②←  COL
|&INPUT
|FUSTYP=1,} NAMELIST INPUT
|&END
CL1607-32   (-24 PLANFORM)   VC121 ENGINE
   1   1  -1   1   1   1   0   7  13   1  17  29                                   2   3   2  10   1  10
 967680
0.        1.        5.        10.       20.       30.       40.       50.       60.       70.          XAF 10
80.       90.       100.                                                                               XAF 13
944.1     65.74     -54.96    1448.94                                                                  WORG 02
1462.5    223.94    -54.47    925.97                                                                   WORG 06
1768.8    317.41    -69.00    650.01                                                                   WORG 08
1905.4    368.04    -77.16    529.67                                                                   WORG 09
2225.8    486.83    -89.74    311.72                                                                   WORG 11
2225.8    486.88    -89.74    311.72                                                                   WORG 12
2479.3    645.05    -99.96    194.45                                                                   WORG 13
0.        -.187     -1.48     -7.09     -18.24    -26.07    -35.64    -41.82    -46.3     -49.4        TZOR 02
-53.13    -56.52    -60.34                                                                             TZOR 02
0.        .49       2.5       2.85      1.06      -2.25     -6.32     -10.75    -15.32    -19.88       TZOR 06
-24.24    -28.42    -32.23                                                                             TZOR 06
0.        .04       1.11      2.27      2.69      2.13      1.        -.51      -2.31     -4.28        TZOR 08
-6.4      -8.6      -10.84                                                                             TZOR 08
0.        .08       .41       1.39      1.64      1.36      .73       -.12      -1.18     -2.34        TZOR 09
-3.71     -5.09     -6.55                                                                              TZOR 09
0.        -.08      -.35      -.36      .16       .4        .6        .72       .82       .91          TZOR 11
.97       1.02      1.05                                                                               TZOR 11
0.        -.08      -.35      -.36      .16       .4        .59       .72       .82       .92          TZOR 12
.97       1.02      1.05                                                                               TZOR 12
0.        -.08      -.35      -.61      -.85      -.92      -.9       -.71      -.4       -.01         TZOR 13
.52       1.13      1.77                                                                               TZOR 13
0.        .46       .89       1.07      1.27      1.4       1.46      1.52      1.55      1.44         WORD  2
1.14      .66       0.                                                                                 WORD  2
0.        .54       .99       1.16      1.34      1.44      1.5       1.51      1.46      1.28         WORD  6
.98       .55       0.                                                                                 WORD  6
0.        .49       .89       1.04      1.18      1.27      1.33      1.351     1.297     1.134        WORD  8
.864      .486      0.                                                                                 WORD  8
0.        .47       .716      .879      1.065     1.192     1.292     1.329     1.276     1.116        WORD  9
.851      .476      0.                                                                                 WORD  9
0.        .47       .723      .903      1.126     1.268     1.364     1.403     1.347     1.179        WORD 11
.898      .507      0.                                                                                 WORD 11
0.        .056      .267      .505      .898      1.179     1.347     1.403     1.347     1.179        WORD 12
.898      .505      0.                                                                                 WORD 12
0.        .056      .271      .512      .911      1.196     1.367     1.424     1.367     1.196        WORD 13
.911      .512      0.                                                                                 WORD 13
0.0       120.      240.      360.      480.      600.      720.      840.      960.      1080.        XFUS 10
```

Figure C-1.- Typical WAVE DRAG format dataset

```
1200.   1320.   1440.   1560.   1680.   1920.   2120.   2240.   2360.   2480.      XFUS 20
2664.3  2720.   2840.   2960.   3060.   3200.   3320.   3440.   3524.              XFUS 30
-38.    -30.75  -23.75  -18.5   -16.2   -15.9   -17.2   -20.9   -26.84  -32.75     ZFUS 10
-36.73  -40.53  -45.07  -49.39  -53.68  -61.59  -68.9   -72.9   -75.0   -76.6      ZFUS 20
-76.8   -76.6   -74.9   -71.3   -66.7   -60.9   -53.3   -44.3   -37.               ZFUS 30
0.      830.    2875.   5242.   8136.   10944.  13752.  16128.  18547.  19584.     AFUS 10
19670.  19670.  20016.  20304.  20548.  20707.  20404.  20073.  19397.  18346.     AFUS 20
16272.  15408.  13248.  10483.  7085.   4464.   2477.   878.    0.                 AFUS 30
2094.   214.    -34.                                                               PODORG 1
0.      137.    393.                                                               PODX 1
33.92   35.65   35.65                                                              PODR 1
2091.   204.    -136.                                                              PODORG 2
0.      136.    394.                                                               PODX 2
32.     35.65   35.65                                                              PODR 2
2480.   645.    -100.   194.5   2595.4  645.    -28.    141.1                      FINORG 1
0.      10.     20.     30.     40.     50.     60.     70.     90.     100.       XFIN
0.      .466    .846    1.138   1.345   1.465   1.498   1.390   .641    0.0        FINORD
3183.9  0.      -27.    294.1   3403.2  0.      66.5    67.7                       FINORG 2
0.      10.     20.     30.     40.     50.     60.     70.     90.     100.       XFIN
0.      .466    .846    1.138   1.345   1.465   1.498   1.390   .641    0.0        FINORD
3116.4  33.     -40.    283.8   3354.   174.4   -40.    76.4                       CANORG
0.0     10.     20.     30.     40.     50.     70.     80.     90.     100.       XCAN
0.0     .553    .948    1.264   1.448   1.5     1.264   .948    .553    0.0        CANORD
267 2550  50    20    0    00000000
268 1200  50    20    0    00000000
269 1000  50     1    0    01000000

INPUT DATA LISTED
```

Figure C-1.- Concluded

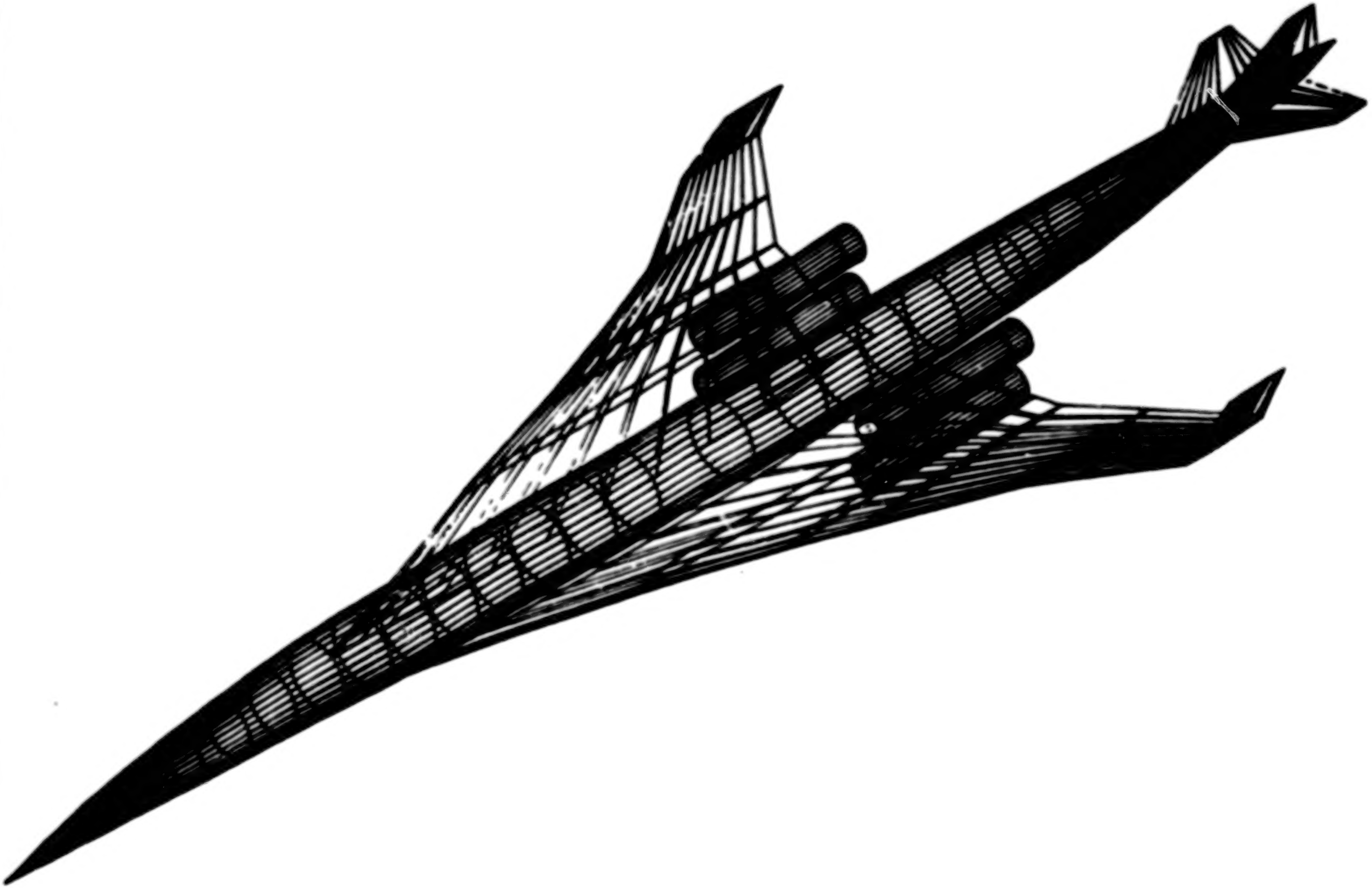


Figure C-2.- Graphic representation of WAVE DRAG dataset

```
CL1607-32   (-24 PLANFORM)   VC121  ENGINE
0          0          1                -0.0200        0.0        0.0        0.0   0         0
1               2.550
3               0.0         5.000      10.000
0               0.0         0.0         0.0        0.0        0.0
12         967680.00      1.0000        0.0        0.0   1290.0996
  944.0999   65.7400   -54.9600  1448.9399             WING PANEL NO. 1
 1462.5000  223.9400   -54.4700   925.9700             WING PANEL NO. 1
    3.0000   10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
    0.0       0.0     0         13         0           0          0
    0.0       1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
   60.0000   70.0000    80.0000    90.0000   100.0000
    0.0      -0.0129    -0.1367    -0.4893    -1.2589    -1.9373    -2.4770    -2.8862
   -3.1954   -3.4439    -3.6668    -3.9008    -4.1644
    0.0       0.0529     0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
   -1.6545   -2.1469    -2.6232    -3.0692    -3.4807
 1462.5000  223.9400   -54.4700   925.9700             WING PANEL NO. 2
 1768.7998  317.4099   -69.0000   650.0098             WING PANEL NO. 2
    3.0000   10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
    0.0       0.0     0         13         0           0          0
    0.0       1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
   60.0000   70.0000    80.0000    90.0000   100.0000
    0.0       0.0529     0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
   -1.6545   -2.1469    -2.6232    -3.0692    -3.4807
    0.0       0.0138     0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
   -0.3554   -0.6585    -0.9846    -1.3231    -1.6677
 1768.7998  317.4099   -69.0000   650.0098             WING PANEL NO. 3
 1905.3999  368.0398   -77.1600   529.8699             WING PANEL NO. 3
    3.0000   10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
    0.0       0.0     0         13         0           0          0
    0.0       1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
   60.0000   70.0000    80.0000    90.0000   100.0000
    0.0       0.0138     0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
   -0.3554   -0.6585    -0.9846    -1.3231    -1.6677
    0.0       0.0151     0.0774     0.2623     0.3095     0.2567     0.1378    -0.0226
   -0.2227   -0.4511    -0.7002    -0.9606    -1.2362
 1905.3999  368.0398   -77.1600   529.8699             WING PANEL NO. 4
 2225.7998  486.8298   -89.7400   311.7200             WING PANEL NO. 4
    3.0000   10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
    0.0       0.0     0         13         0           0          0
    0.0       1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
   60.0000   70.0000    80.0000    90.0000   100.0000
    0.0       0.0151     0.0774     0.2623     0.3095     0.2567     0.1378    -0.0226
   -0.2227   -0.4511    -0.7002    -0.9606    -1.2362
    0.0      -0.0257    -0.1123    -0.1155     0.0513     0.1283     0.1925     0.2310
    0.2631    0.2919     0.3112     0.3272     0.3368
```

Figure C-3.- Listing of output dataset in VORLAX format

```
 2225.7998  486.8298  -89.7400  311.7200            WING PANEL NO. 5
 2225.7998  486.8799  -89.7400  311.7200            WING PANEL NO. 5
    3.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
    0.0       0.0    0          13          0          0          0
    0.0       1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1925    0.2310
    0.2631    0.2919    0.3112    0.3272    0.3368
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
 2225.7998  486.8799  -89.7400  311.7200            WING PANEL NO. 6
 2479.2998  645.0498  -99.9600  194.4500            WING PANEL NO. 6
    3.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
    0.0       0.0    0          13          0          0          0
    0.0       1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
    0.0      -0.0411   -0.1800   -0.3137   -0.4371   -0.4731   -0.4628   -0.3651
   -0.2057   -0.0051    0.2674    0.5811    0.9103
    0.0       0.0      45.7619 3524.0000            FUSELAGE PANEL
    0.0       0.0     -97.8677 3524.0000            FUSELAGE PANEL
    4.0000   28.0000    1.0000  999.0000            NVOR,RNCV,SPC,PDL
   90.0000   71.8148   33.1318   71.8148  -23.7363   71.8148  -90.0000   71.8148
    0.0       0.0    1          29          0          0          1
    0.0       3.4052    6.8104   10.2157   13.6209   17.0261   20.4313   23.8365
   27.2418   30.6470   34.0522   37.4574   40.8627   44.2679   47.6731   54.4835
   60.1565   63.5641   66.9693   70.3746   75.6044   77.1850   80.5902   83.9955
   87.4007   90.8059   94.2111   97.6163  100.0000
   -1.0785   -0.3726   -0.6729   -0.5250   -0.4547   -0.4512   -0.4881   -0.5931
   -0.7616   -0.9297   -1.0423   -1.1501   -1.2785   -1.4015   -1.5233   -1.7477
   -1.9552   -2.0687   -2.1783   -2.1737   -2.1795   -2.1737   -2.1254   -2.0233
   -1.8927   -1.7281   -1.5125   -1.2571   -1.0499
    0.0       5.1227   17.7443   32.3533   50.2150   67.5458   84.0766  100.0000
  100.0000  100.0000  100.0000  100.0000  100.0000  100.0000  100.0000  100.0000
  100.0000  100.0000  100.0000  100.0000  100.4297   95.0974   81.7659   54.7005
   42.7282   27.5516   15.2879    5.4190    0.0
 2094.0000  214.0000   -0.0300  393.0000            NACELLE PANEL NO 1
 2094.0000  274.0000   -0.0300  593.0000            NACELLE PANEL NO 1
    6.0000    5.0000    0.0     444.0000            NVOR,RNCV,SPC,PDL
   90.0000   33.9200   30.0000   33.9200  -30.0000   33.9200  -90.0000   33.9200
 -150.0000   33.9200 -210.0000   33.9200 -270.0000   33.9200
    0.0       0.0    0          3           0          0          1
    0.0      12.1522  100.0000
    0.0
  100.0000  105.1001  105.1001
```

Figure C-3.- Continued

```
2091.0000  204.0000 -104.0000  394.0000                    NACELLE PANEL NO 2
2091.0000  204.0000 -104.0000  394.0000                    NACELLE PANEL NO 2
   6.0000    5.0000    0.0     444.0000                    NVOR,RNCV,SPC,PDL
  90.0000   32.0000   30.0000   32.0000  -30.0000   32.0000  -90.0000   32.0000
-150.0000   32.0000 -210.0000   32.0000 -270.0000   32.0000
   0.0       0.0     0          5         0          0          1
   0.0      11.9149  100.0000
  0.0
 100.0000  111.4062  111.4062
2480.0000  645.0000 -100.0000  194.5000                    FIN PANEL NO. 1
2595.3999  645.0000  -28.0000  141.1000                    FIN PANEL NO. 1
   2.0000   10.0000    1.0000    0.0                       NVOR,RNCV,SPC,PDL
   0.0       0.0     0          0         0          0          0
3183.0999    0.0     -27.0000  294.0999                    FIN PANEL NO. 2
3403.2000    0.0      66.5000   67.7000                    FIN PANEL NO. 2
   2.0000   10.0000    1.0000    0.0                       NVOR,RNCV,SPC,PDL
   0.0       0.0     0          0         0          0          0
3116.3999   33.0000  -40.0000  283.7998                    CANARD PANEL NO. 1
3354.0000  174.4000  -40.0000   76.4000                    CANARD PANEL NO. 1
   2.0000   10.0000    1.0000    0.0                       NVOR,RNCV,SPC,PDL
   0.0       0.0     0          0         0          0          0
0          0         0          0         NXS,NYS,NZS
```

Figure C-3.- Concluded

```
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
  1  1 -1   1   1   1   0   6 13   1   5 29   0   0   0   0   0   0   2   3   2   2   1   2
 967680                                                                                  REFA
   0.0      1.00     5.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00        XAF
  90.00    90.00   100.00
 944.10    65.74   -54.961448.94                                                         WORG
1462.50   223.94   -54.47  925.97                                                        WORG
1758.80   317.41   -69.00  650.01                                                        WORG
1905.40   368.04   -77.16  529.87                                                        WORG
2225.60   496.38   -89.74  311.72                                                        WORG
2479.30   645.05   -99.96  194.45                                                        WORG
   0.0     -0.15    -1.99   -7.09  -18.24  -28.07  -35.89  -41.82  -46.30  -49.90        TZORD
 -53.13   -56.52   -60.34
   0.0      0.49     2.50    2.95    1.06   -2.25   -6.32  -10.75  -15.32  -19.88        TZORD
 -24.29   -28.42   -32.23
   0.0      0.04     1.11    2.27    2.69    2.13    1.00   -0.51   -2.31   -4.28        TZORD
  -6.40    -8.60   -10.94
   0.0      0.08     0.41    1.39    1.64    1.36    0.73   -0.12   -1.18   -2.39        TZORD
  -3.71    -5.09    -6.55
   0.0     -0.09    -0.35   -0.36    0.16    0.40    0.59    0.72    0.82    0.92        TZORD
   0.97     1.02     1.05
   0.0     -0.08    -0.35   -0.61   -0.85   -0.92   -0.90   -0.71   -0.40   -0.01        TZORD
   0.52     1.13     1.77
   0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0         WORD
   0.0      0.0      0.0
   0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0         WORD
   0.0      0.0      0.0
   0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0         WORD
   0.0      0.0      0.0
   0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0         WORD
   0.0      0.0      0.0
   0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0         WORD
   0.0      0.0      0.0
   0.0      0.0      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0         WORD
   0.0      0.0      0.0
    0.0  120.00  240.00  360.00  480.00  600.00  720.00  840.00  960.001080.00           XFUS
1200.001320.001440.001560.001680.001920.002120.002240.002360.002480.00                   XFUS
2654.302720.002840.002960.003080.003200.003320.003440.003524.00
 -35.00  -30.75  -25.75  -19.50  -16.20  -15.90  -17.20  -20.90  -26.84  -32.75          ZFUS
 -36.72  -40.53  -45.07  -49.39  -53.68  -61.59  -68.90  -72.90  -75.00  -76.60          ZFUS
 -76.80  -76.60  -74.90  -71.30  -66.70  -60.90  -53.20  -44.30  -37.00
    0.0   830.0  2875.0  5242.0  8136.010944.013752.016202.316202.316202.3               AFUS
16202.316202.316202.316202.316202.316202.316202.316202.316202.316202.3                   AFUS
16271.415408.013248.010483.0  7085.0  4464.0  2477.0   878.0     0.0
```

Figure C-4.- Result of converting circular fuselage VORLAX dataset back to WAVE DRAG format

```
 2094.00  214.00   -0.08                                                         PODORG  1
    0.0    47.76  393.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0 XPOD    1
   33.92   34.77   34.77     0.0     0.0     0.0     0.0     0.0     0.0     0.0 PODORD  1
 2091.00  204.00-104.00                                                          PODORG  2
    0.0    46.94  394.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0 XPOD    2
   32.00   33.78   33.78     0.0     0.0     0.0     0.0     0.0     0.0     0.0 PODORD  2
  2480.0   645.0  -100.0   194.5  2595.4   645.0   -28.0   141.1                 FINORG
     0.0   100.0                                                                 XFIN
     0.0     0.0                                                                 FINORD
  3183.9     0.0   -27.0   294.1  3403.2     0.0    66.5    67.7                 FINORG
     0.0   100.0                                                                 XFIN
     0.0     0.0                                                                 FINORD
  3116.4    33.0   -40.0   283.8  3354.0   174.4   -40.0    76.4                 CANORG
     0.0   100.0                                                                 XCAN
     0.0     0.0                                                                 CANORD
X Y                                                   10.00ORT
X Z     26.62-24.139.23                               12.25ORT                    1
```

Figure C-4.- Concluded

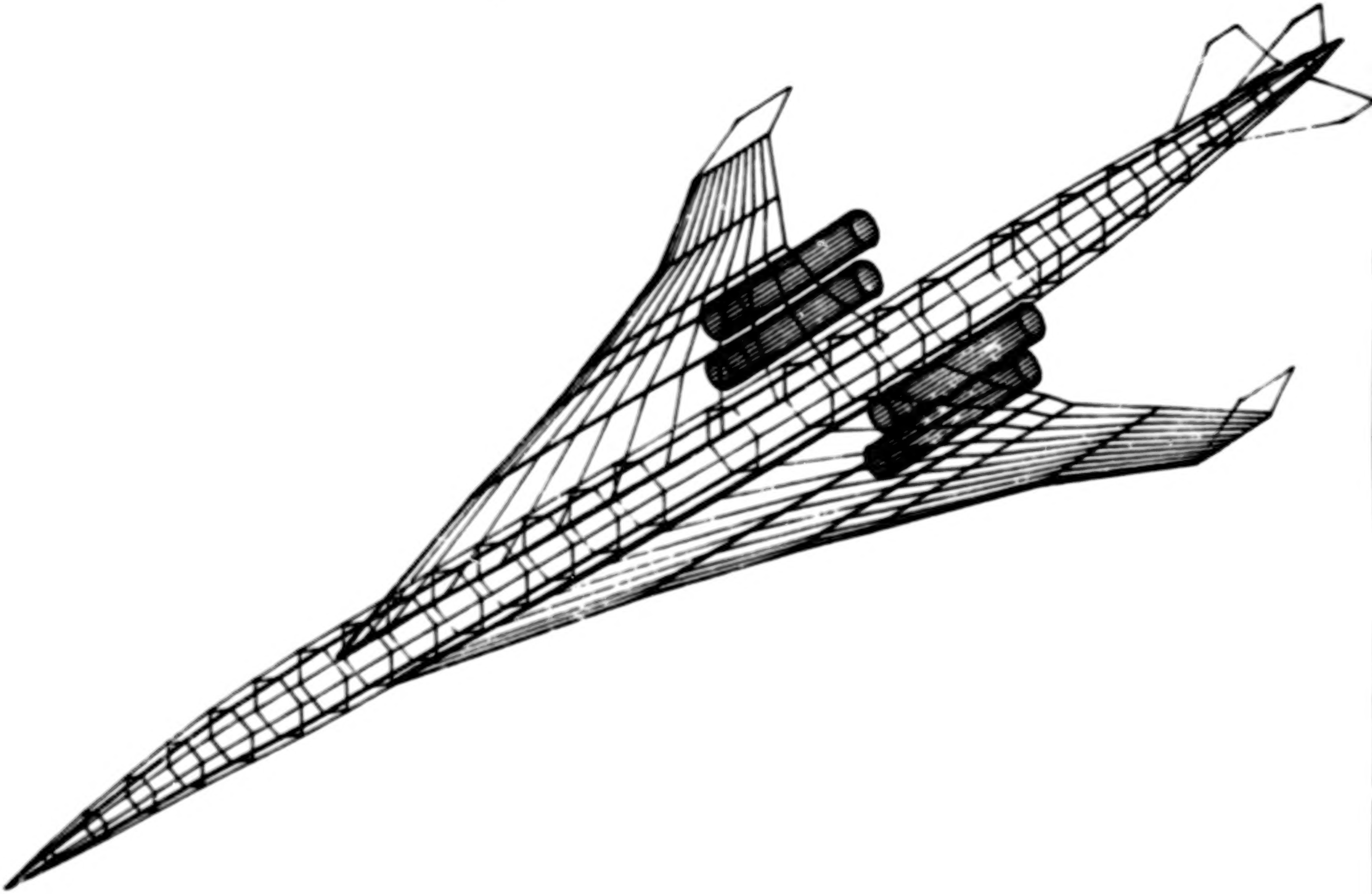


Figure C-5.- Plot of figure C-4 dataset

```
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
  1  1  1  1  1  1  0  6 13  1  3  4  0  0  0  0  0  0  2  3  4  2  1  2
 967680                                                                 REFA
    0.0   1.00   5.00  10.00  20.00  30.00  40.00  50.00  60.00  70.00 XAF
  80.00  90.00 100.00
 944.10  65.74 -54.961448.94                                            WORG
1462.50 223.94 -54.47 925.97                                            WORG
1768.80 317.41 -69.00 650.01                                            WORG
1905.40 368.04 -77.16 529.87                                            WORG
2225.80 486.88 -89.74 311.72                                            WORG
2479.30 645.05 -99.96 194.45                                            WORG
    0.0  -0.19  -1.98  -7.09 -18.24 -28.07 -35.89 -41.82 -46.30 -49.90 TZORD
 -53.13 -56.52 -60.34
    0.0   0.49   2.50   2.85   1.06  -2.25  -6.32 -10.75 -15.32 -19.88 TZORD
 -24.29 -28.42 -32.23
    0.0   0.09   1.11   2.27   2.69   2.13   1.00  -0.51  -2.31  -4.28 TZORD
  -6.40  -8.60 -10.84
    0.0   0.08   0.41   1.39   1.64   1.36   0.73  -0.12  -1.18  -2.39 TZORD
  -3.71  -5.09  -6.55
    0.0  -0.08  -0.35  -0.36   0.16   0.40   0.59   0.72   0.82   0.92 TZORD
   0.97   1.02   1.05
    0.0  -0.08  -0.35  -0.61  -0.85  -0.92  -0.90  -0.71  -0.40  -0.01 TZORD
   0.52   1.13   1.77
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0 257.703362.573524.00    0.0    0.0                              XFUS
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 YFUS
 -54.96 -54.96 -54.96    0.0    0.0    0.0    0.0    0.0    0.0    0.0 ZFUS
    0.0  65.74    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 YFUS
 -54.96 -54.96 -54.96    0.0    0.0    0.0    0.0    0.0    0.0    0.0 ZFUS
    0.0  65.74    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 YFUS
 -54.96 -54.96 -54.96    0.0    0.0    0.0    0.0    0.0    0.0    0.0 ZFUS
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 YFUS
 -54.96 -54.96 -54.96    0.0    0.0    0.0    0.0    0.0    0.0    0.0 ZFUS
2094.00 223.94  -0.08                                                   PODORG 1
    0.0  47.76 393.00    0.0    0.0    0.0    0.0    0.0    0.0    0.0 XPOD   1
  33.92  33.92  33.92    0.0    0.0    0.0    0.0    0.0    0.0    0.0 PODORD 1
```

Figure C-6 - Result of converting flat fuselage dataset back to WAVE DRAG format

```
2091.00 223.94-104.00                                                    PODORG  2
    0.0  46.94 394.00    0.0    0.0     0.0    0.0    0.0   0.0    0.0   XPOD    2
  32.00  32.00  32.00    0.0    0.0     0.0    0.0    0.0   0.0    0.0   PODORD  2
 2094.0  223.9  -34.0  393.0 2094.0   223.9  -54.6  393.0                FINORG
    0.0  100.0                                                           XFIN
    0.0    0.0                                                           FINORD
 2091.0  223.9  -54.6  394.0 2091.0   223.9  -72.0  394.0                FINORG
    0.0  100.0                                                           XFIN
    0.0    0.0                                                           FINORD
 2480.0  645.0 -100.0  194.5 2595.4   645.0  -28.0  141.1                FINORG
    0.0  100.0                                                           XFIN
    0.0    0.0                                                           FINORD
 3171.4   65.7  -40.0  235.8 3171.4    65.7  -55.0  235.8                FINORG
    0.0  100.0                                                           XFIN
    0.0    0.0                                                           FINORD
 3171.4   65.7  -40.0  235.8 3354.0   174.4  -40.0   76.4                CANORG
    0.0  100.0                                                           XCAN
    0.0    0.0                                                           CANORD
X Y                                             10.000RT
X Z    26.62-24.139.23                          12.250RT                1
```

Figure C-6.- Concluded

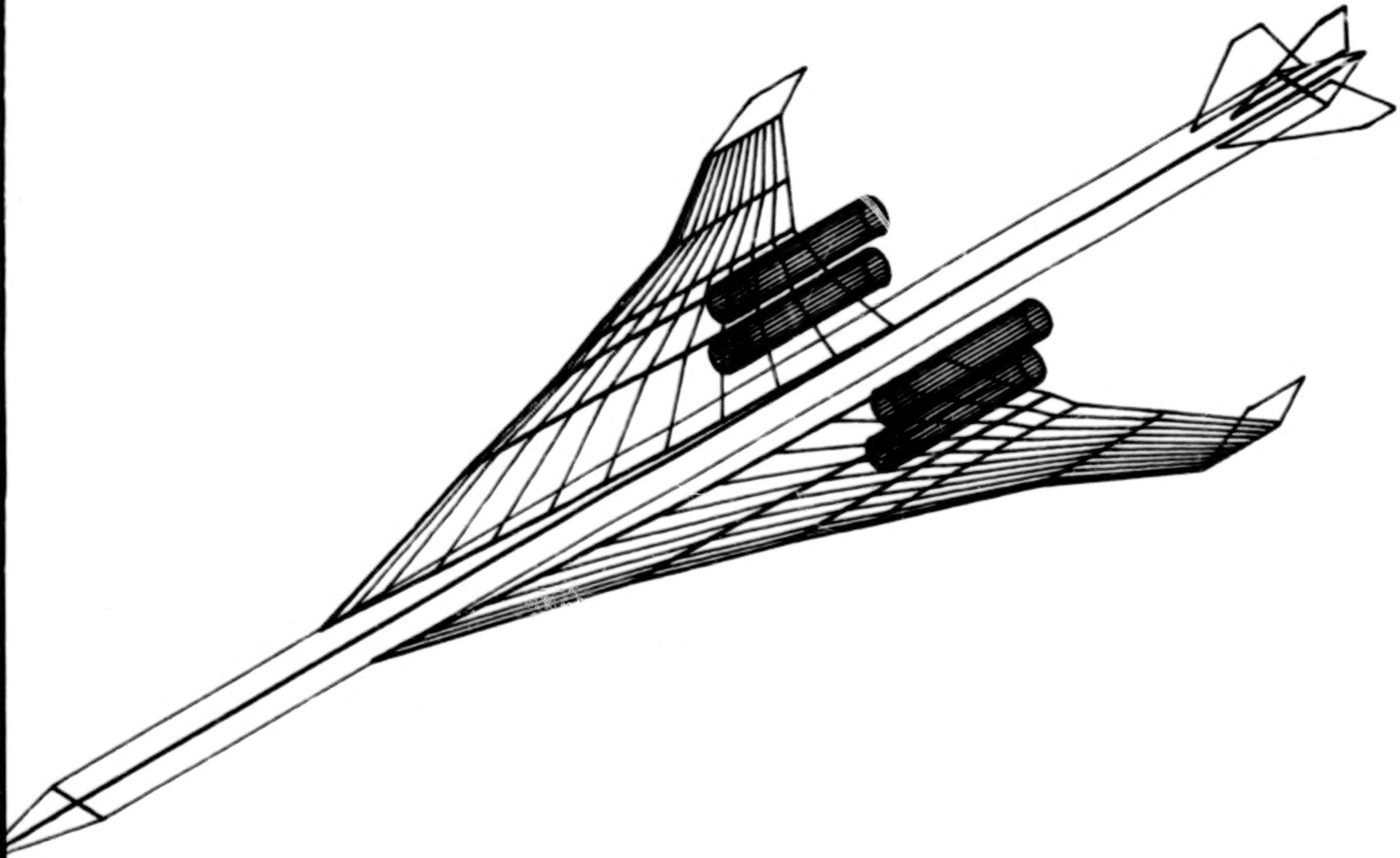


Figure C-7.- Plot of figure C-6 dataset

```
CL1607-32    (-24 PLANFORM)     VC121 ENGINE
 0           0           1               -0.0200     0.0         0.0         0.0     0         0
 1                 2.550
 3                0.0         5.000      10.000
 0                0.0         0.0         0.0         0.0         0.0
12             967680.00      1.0000     0.0         0.0      1290.0996
    944.0999     65.7400    -54.9600   1448.9395            WING PANEL NO. 1
   1462.5000    223.9400    -54.4700    925.9700            WING PANEL NO. 1
      3.0000     10.0000      1.0000         0.0            NVOR,RNCV,SPC,PDL
         0.0         0.0 0         13          0           0           0
         0.0      1.0000      5.0000     10.0000     20.0000     30.0000     40.0000     50.0000
     60.0000     70.0000     80.0000     90.0000    100.0000
         0.0     -0.0129     -0.1367     -0.4893     -1.2589     -1.9373     -2.4770     -2.8862
     -3.1954     -3.4439     -3.6668     -3.9008     -4.1644
         0.0      0.0529      0.2700      0.3078      0.1145     -0.2430     -0.6825     -1.1609
     -1.6545     -2.1469     -2.6232     -3.0692     -3.4807
   1462.5000    223.9400    -54.4700    925.9700            WING PANEL NO. 2
   1768.7998    317.4099    -69.0000    650.0099            WING PANEL NC. 2
      3.0000     10.0000      1.0000         0.0            NVOR,RNCV,SPC,PDL
         0.0         0.0 0         13          0           0           0
         0.0      1.0000      5.0000     10.0000     20.0000     30.0000     40.0000     50.0000
     60.0000     70.0000     80.0000     90.0000    100.0000
         0.0      0.0529      0.2700      0.3078      0.1145     -0.2430     -0.6825     -1.1609
     -1.6545     -2.1469     -2.6232     -3.0692     -3.4807
         0.0      0.0133      0.1708      0.3492      0.4138      0.3277      0.1538     -0.0785
     -0.3554     -0.6585     -0.9846     -1.3221     -1.6677
   1768.7998    317.4099    -69.0000    650.0098            WING PANEL NO. 3
   1905.3999    368.0398    -77.1600    529.8699            WING PANEL NC. 3
      3.0000     10.0000      1.0000         0.0            NVOR,RNCV,SPC,PDL
         0.0         0.0 0         13          0           0           0
         0.0      1.0000      5.0000     10.0000     20.0000     30.0000     40.0000     50.0000
     60.0000     70.0000     80.0000     90.0000    100.0000
         0.0      0.0138      0.1708      0.3492      0.4138      0.3277      0.1538     -0.0785
     -0.3554     -0.6585     -0.9846     -1.3231     -1.6677
         0.0      0.0151      0.0774      0.2623      0.3095      0.2567      0.1378     -0.0226
     -0.2227     -0.4511     -0.7002     -0.9606     -1.2362
   1905.3999    368.0398    -77.1600    529.8699            WING PANEL NO. 4
   2225.7998    486.8298    -89.7400    311.7200            WING PANEL NO. 4
      3.0000     10.0000      1.0000         0.0            NVOR,RNCV,SPC,PDL
         0.0         0.0 0         13          0           0           0
         0.0      1.0000      5.0000     10.0000     20.0000     30.0000     40.0000     50.0000
     60.0000     70.0000     90.0000     90.0000    100.0000
         0.0      0.0151      0.0774      0.2623      0.3095      0.2567      0.1379     -0.0226
     -0.2227     -0.4511     -0.7002     -0.9606     -1.2362
         0.0     -0.0757     -0.1123     -0.1155      0.0513      0.1283      0.1925      0.2310
      0.2631      0.2919      0.3112      0.3272      0.3368
```

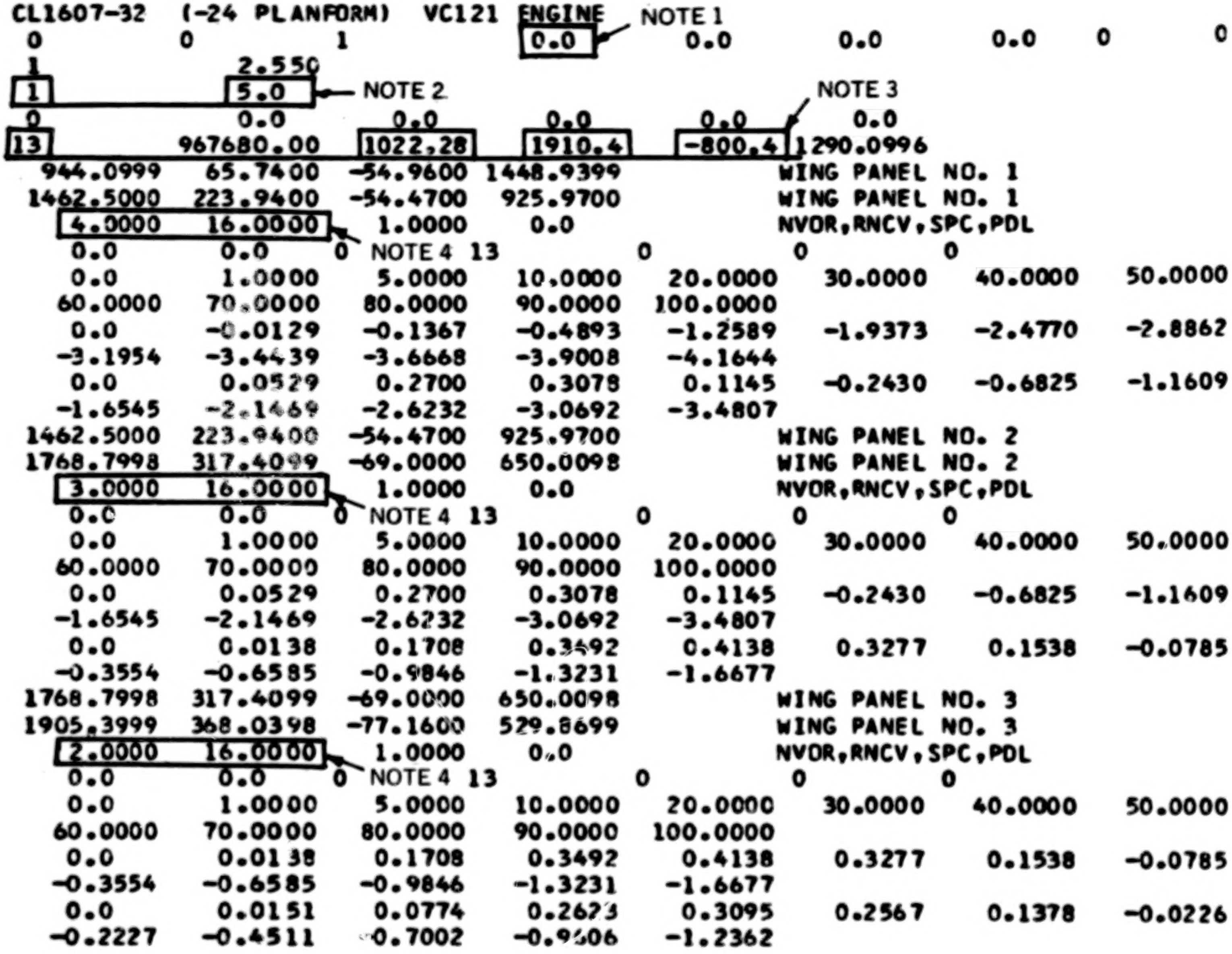
Figure C-8.- Converted dataset before editing for VORLAX run

```
 2225.7998  486.8298  -89.7400  311.7200            WING PANEL NO. 5
 2225.7998  486.8799  -89.7400  311.7200            WING PANEL NO. 5
    3.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
    0.0       0.0     0         13         0         0         0
    0.0       1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1925    0.2310
    0.2631    0.2919    0.3112    0.3272    0.3368
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
 2225.7998  486.8799  -89.7400  311.7200            WING PANEL NO. 6
 2479.2998  645.0498  -99.9600  194.4500            WING PANEL NO. 6
    3.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
    0.0       0.0     0         13         0         0         0
    0.0       1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
    0.0      -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
    0.0      -0.0411   -0.1800   -0.3137   -0.4371   -0.4731   -0.4628   -0.3651
   -0.2057   -0.0051    0.2674    0.5811    0.9103
    0.0       0.0     -54.9600 3524.0000            FUSELAGE PANEL
  257.7026   65.7400  -54.9600 3104.8645            FUSELAGE PANEL
    3.0000    2.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
    0.0       0.0     0         29         0         0         0
    0.0       3.4052    6.8104   10.2157   13.6209   17.0261   20.4313   23.8365
   27.2418   30.6470   34.0522   37.4574   40.8627   44.2679   47.6731   54.4835
   60.1589   63.5641   66.9693   70.3746   75.6044   77.1850   80.5902   83.9955
   87.4007   90.8059   94.2111   97.6163  100.0000
   -1.5596   -1.3539   -1.1552   -1.0067   -0.9410   -0.9325   -0.9694   -1.0743
   -1.2429   -1.4106   -1.5236   -1.6314   -1.7602   -1.8828   -2.0045   -2.2290
   -2.4364   -2.5499   -2.6095   -2.6549   -2.6606   -2.6549   -2.6067   -2.5045
   -2.3740   -2.2094   -1.9938   -1.7384   -1.5312
   -1.5596   -1.3539   -1.1552   -1.0062   -0.9410   -0.9325   -0.9694   -1.0743
   -1.2429   -1.4106   -1.5236   -1.6314   -1.7602   -1.8828   -2.0045   -2.2290
   -2.4364   -2.5499   -2.6095   -2.6549   -2.6606   -2.6549   -2.6067   -2.5045
   -2.3740   -2.2094   -1.9938   -1.7384   -1.5312
 2094.0000  214.0000   -0.0800  393.0000            NACELLE PANEL NO 1
 2094.0000  214.0000   -0.0800  393.0000            NACELLE PANEL NO 1
    6.0000    5.0000    0.0     600.0000            NVOR,RNCV,SPC,PDL
   90.0000   33.9200   30.0000   33.9200  -30.0000   33.9200  -90.0000   33.9200
 -150.0000   33.9200 -210.0000   33.9200 -270.0000   33.9200
    0.0       0.0     0         3          0         0         1
    0.0      12.1522  100.0000
   0.0
  100.0000  105.1001  105.1001
```

Figure C-8.- Continued

```
2091.0000  204.0000 -104.0000  394.0000            NACELLE PANEL NO 2
2091.0000  204.0000 -104.0000  394.0000            NACELLE PANEL NO 2
   6.0000    5.0000    0.0     999.0000            NVOR,RNCV,SPC,PDL
  90.0000   32.0000   30.0000   32.0000  -30.0000   32.0000  -90.0000   32.0000
-150.0000   32.0000 -210.0000   32.0000 -270.0000   32.0000
   0.0       0.0    0          3         0          0          1
   0.0      11.9148  100.0000
  0.0
 100.0000  111.4062  111.4062
2480.0000  645.0000 -100.0000  194.5000            FIN PANEL NO. 1
2595.3999  645.0000  -28.0000  141.1000            FIN PANEL NO. 1
   2.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
   0.0       0.0    0          0         0          0          0
3183.8999    0.0     -27.0000  294.0999            FIN PANEL NO. 2
3403.2000    0.0      66.5000   67.7000            FIN PANEL NO. 2
   2.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
   0.0       0.0    0          0         0          0          0
3116.3999   33.0000  -40.0000  283.7998            CANARD PANEL NO. 1
3354.0000  174.4000  -40.0000   76.4000            CANARD PANEL NO. 1
   2.0000   10.0000    1.0000    0.0               NVOR,RNCV,SPC,PDL
   0.0       0.0    0          0         0          0          0
0          0        0                    NXS,NYS,NZS
```

Figure C-8.- Concluded



```
CL1607-32  (-24 PLANFORM)  VC121 ENGINE   NOTE 1
  0          0          1           0.0          0.0        0.0        0.0    0      0
  1                2.550
  1                5.0    NOTE 2                                 NOTE 3
  0                0.0        0.0        0.0        0.0        0.0
 13           967680.00    1022,28    1910.4     -800.4 1290.0996
    944.0999     65.7400   -54.9600 1448.9399            WING PANEL NO. 1
   1462.5000    223.9400   -54.4700  925.9700            WING PANEL NO. 1
      4.0000     16.0000     1.0000      0.0             NVOR,RNCV,SPC,PDL
      0.0         0.0      0  NOTE 4  13          0          0          0
      0.0         1.0000     5.0000    10,0000    20.0000    30.0000    40.0000    50.0000
     60.0000     70.0000    80.0000    90.0000   100.0000
      0.0        -0.0129    -0.1367    -0.4893    -1.2589    -1.9373    -2.4770    -2.8862
     -3.1954     -3.4439    -3.6668    -3.9008    -4.1644
      0.0         0.0529     0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
     -1.6545     -2.1469    -2.6232    -3.0692    -3.4807
   1462.5000    223.9400   -54.4700   925.9700            WING PANEL NO. 2
   1768.7998    317.4099   -69.0000   650.0098            WING PANEL NO. 2
      3.0000     16.0000     1.0000      0.0             NVOR,RNCV,SPC,PDL
      0.0         0.0      0  NOTE 4  13          0          0          0
      0.0         1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
     60.0000     70.0000    80.0000    90.0000   100.0000
      0.0         0.0529     0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
     -1.6545     -2.1469    -2.6232    -3.0692    -3.4807
      0.0         0.0138     0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
     -0.3554     -0.6585    -0.9846    -1.3231    -1.6677
   1768.7998    317.4099   -69.0000   650.0098            WING PANEL NO. 3
   1905.3999    368.0398   -77.1600   529.8699            WING PANEL NO. 3
      2.0000     16.0000     1.0000      0.0             NVOR,RNCV,SPC,PDL
      0.0         0.0      0  NOTE 4  13          0          0          0
      0.0         1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
     60.0000     70.0000    80.0000    90.0000   100.0000
      0.0         0.0138     0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
     -0.3554     -0.6585    -0.9846    -1.3231    -1.6677
      0.0         0.0151     0.0774     0.2623     0.3095     0.2567     0.1378    -0.0226
     -0.2227     -0.4511    -0.7002    -0.9606    -1.2362
```

Figure C-9.- Converted dataset after editing for VORLAX run

```
1905.3999   368.0398   -77.1600   529.8699              WING PANEL NO. 4
2225.7998   486.8298   -89.7400   311.7200              WING PANEL NO. 4
   4.0000    16.0000     1.0000     0.0                 NVOR,RNCV,SPC,PDL
   0.0        0.0      0 NOTE 4 13           0            0            0
   0.0        1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
  60.0000    70.0000    80.0000    90.0000   100.0000
   0.0        0.0151     0.0774     0.2623     0.3095     0.2567     0.1378    -0.0226
  -0.2227    -0.4511    -0.7002    -0.9606    -1.2362
   0.0       -0.0257    -0.1123    -0.1155     0.0513     0.1283     0.1925     0.2310
   0.2631     0.2919     0.3112     0.3272     0.3368
                                                                       NOTE 5
2225.7998   486.8799   -89.7400   311.7200              WING PANEL NO. 6
2479.2998   645.0498   -99.9600   194.4500              WING PANEL NO. 6
   5.0000    16.0000     1.0000     0.0                 NVOR,RNCV,SPC,PDL
   0.0        0.0      0 NOTE 4 13           0            0            0
   0.0        1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
  60.0000    70.0000    80.0000    90.0000   100.0000
   0.0       -0.0257    -0.1123    -0.1155     0.0513     0.1283     0.1893     0.2310
   0.2631     0.2951     0.3112     0.3272     0.3368
   0.0       -0.0411    -0.1800    -0.3137    -0.4371    -0.4731    -0.4628    -0.3651
  -0.2057    -0.0051     0.2674     0.5811     0.9103
   0.0        0.0      -54.9600  3574.0000              FUSELAGE PANEL
 257.7026    65.7400   -54.9600  3104.8645              FUSELAGE PANEL
   3.0000    24.000      0.0        0.0                 NVOR,RNCV,SPC,PDL
   0.0        0.0      0 NOTE 4 29           0            0            0
   0.0        3.4052     6.8104    10.2157    13.6209    17.0261    20.4313    23.8365
  27.2418    30.6470    34.0522    37.4574    40.8627    44.2679    47.6731    54.4835
  60.1589    63.5641    66.9693    70.3746    75.6044    77.1850    80.5902    83.9955
  87.4007    90.8059    94.2111    97.6163   100.0000
  -1.5596    -1.3539    -1.1552    -1.0062    -0.9410    -0.9325    -0.9694    -1.0743
  -1.2429    -1.4106    -1.5236    -1.6314    -1.7602    -1.9828    -2.0045    -2.2290
  -2.4364    -2.5499    -2.6095    -2.6549    -2.6606    -2.6549    -2.6067    -2.5045
  -2.3740    -2.2094    -1.9938    -1.7384    -1.5312
  -1.5596    -1.3539    -1.1552    -1.0062    -0.9410    -0.9325    -0.9694    -1.0743
  -1.2429    -1.4106    -1.5236    -1.6314    -1.7602    -1.8828    -2.0045    -2.2290
  -2.4364    -2.5499    -2.6095    -2.6549    -2.6606    -2.6549    -2.6067    -2.5045
  -2.3740    -2.2094    -1.9938    -1.7384    -1.5312
```

Figure C-9.- Continued

```
2094.          223.94     -34.         393.                       UPPER NACELLE PYLON  \
2094.          223.94     -54.470      393.                       UPPER NACELLE PYLON   } NOTE 6
1.         10.                                                                        /
0.                     NOTE 7
  2094.0000   223.9400    -0.0800    393.0000                     NACELLE PANEL NO 1
  2094.0000   223.9400    -0.0800    393.0000                     NACELLE PANEL NO 1
NOTE 4 6.0000    10.000      0.0     999.0000                     NVOR,RNCV,SPC,PDL
    90.0000    33.9200    30.0000    33.9200    -30.0       33.9200  -90.0000   33.9200
  -150.000     33.9200  -210.0000    33.9200  -270.0000     33.9200
     0.0        0.0      0           3           0           0          1
     0.0       12.1522   100.0000
0.
  100.0000    100.0000   100.0000  <- NOTE 8
2091.         223.94     -54.470      394.                        LOWER NACELLE PYLON
2091.         223.94     -72.00       394.                        LOWER NACELLE PYLON
1.            10.
0.            0.       NOTE 9
  2091.0000   223.9400  -104.0000    394.0000                     NACELLE PANEL NO 2
  2091.0000   223.9400  -104.0000    394.0000                     NACELLE PANEL NO 2
NOTE 4 6.0000    10.000      0.0     999.0000                     NVOR,RNCV,SPC,PDL
    90.0000    32.0000    30.0000    32.0000    -30.0       32.0000  -90.0000   32.0000
  -150.000     32.0000  -210.0000    32.0000  -270.0000     32.0000
     0.0        0.0      0           3           0           0          1
     0.0       11.9148   100.0000
0.
  100.0000    100.0000   100.0000  <- NOTE 8
  2480.0000   645.0000  -100.0000    194.5000                     FIN PANEL  NO. 1
  2595.3999   645.0000   -28.0000    141.1000                     FIN PANEL  NO. 1
     4.0000    10.0000     1.0000      0.0                        NVOR,RNCV,SPC,PDL
     0.0        0.0      0           0           0           0          0



                                                               <------- NOTE 10
```

Figure C-9.- Continued

```
   3171.3600     65.7396     -40.0000     235.7760  NOTE 11  CANARD PANEL NO. 1
   3354.0000    174.4000     -40.0000      76.4000           CANARD PANEL NO. 1
NOTE 4  6.0000    9.0000       1.0000       0.0              NVOR,RNCV,SPC,PDL
      0.0          0.0       0          0          0          0          0
  3171.36     65.7396     -40.         235.776               HORIZONTAL TAIL SEAL
  3171.36     65.7396     -54.96       235.776               HORIZONTAL TAIL SEAL     NOTE 12
  1.          9.          0.
  0.          0.          0          0          0          0          0
   0           0          0                     NXS,NYS,NZS
```

Figure C-9.- Concluded

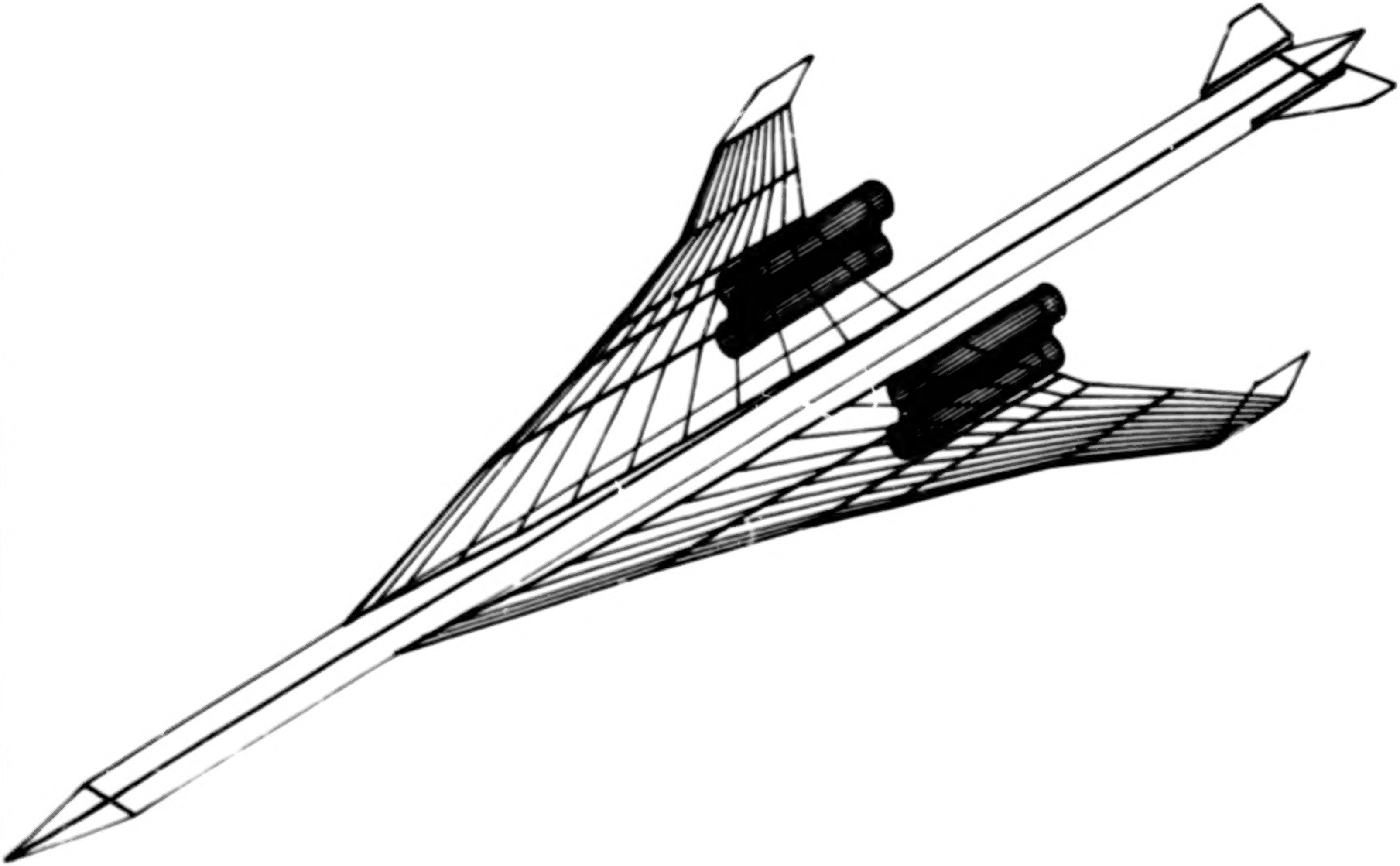
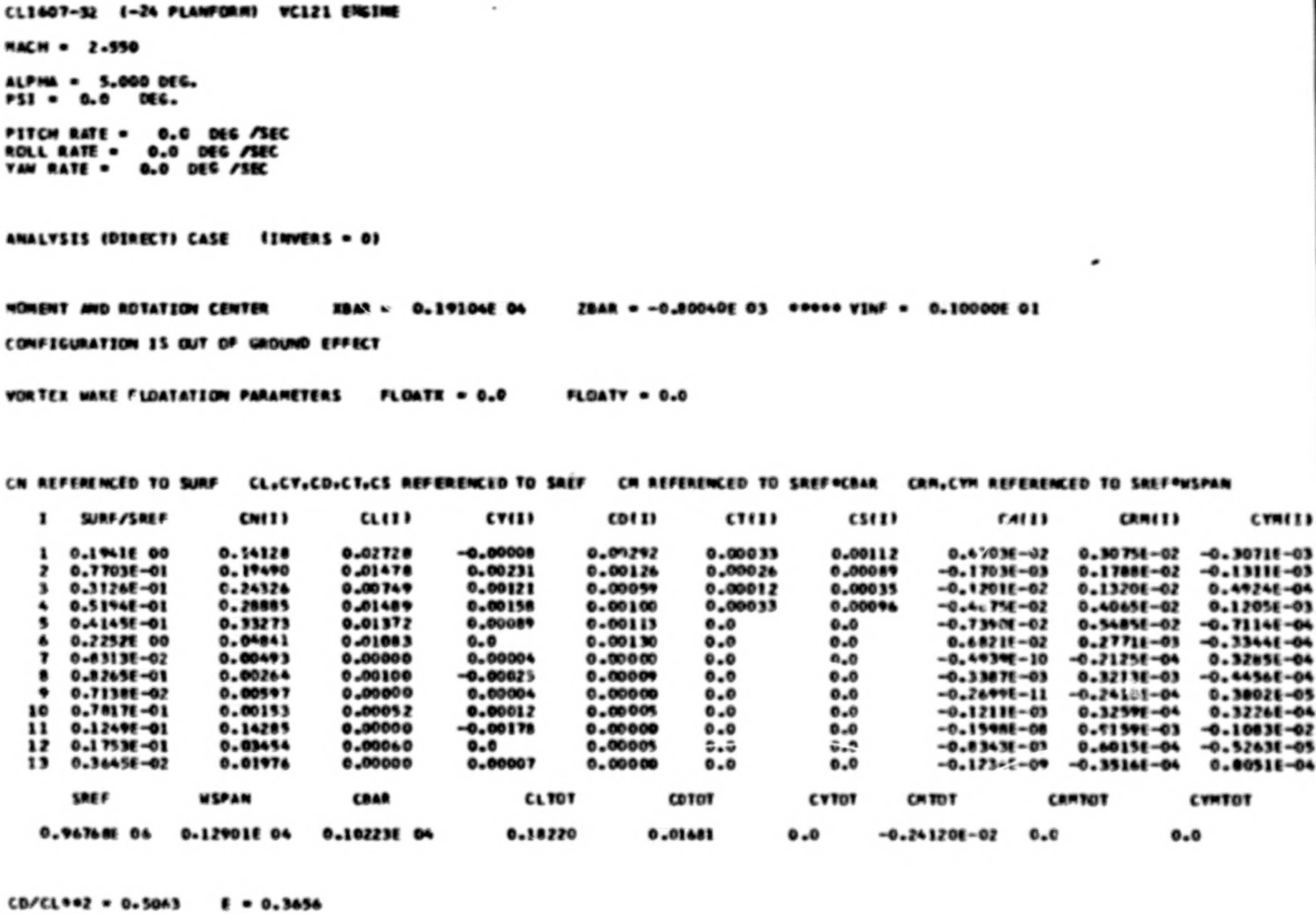


Figure C-10.- Plot of dataset edited for submittal to VORLAX



```
CL1607-32  (-24 PLANFORM)  VC121 ENGINE

MACH =  2.550

ALPHA =  5.000 DEG.
PSI =  0.0   DEG.

PITCH RATE =   0.0  DEG /SEC
ROLL RATE =   0.0  DEG /SEC
YAW RATE =   0.0  DEG /SEC


ANALYSIS (DIRECT) CASE   (INVERS = 0)


MOMENT AND ROTATION CENTER      XBAR =  0.19104E 04     ZBAR = -0.80040E 03  ***** VINF =  0.10000E 01

CONFIGURATION IS OUT OF GROUND EFFECT


VORTEX WAKE FLOATATION PARAMETERS    FLOATX = 0.0      FLOATY = 0.0



CN REFERENCED TO SURF   CL,CY,CD,CT,CS REFERENCED TO SREF   CM REFERENCED TO SREF*CBAR   CRM,CYM REFERENCED TO SREF*WSPAN

   I    SURF/SREF       CN(I)       CL(I)       CY(I)       CD(I)       CT(I)       CS(I)        CM(I)       CRM(I)       CYM(I)

   1  0.1941E 00     0.54128     0.02720    -0.00008     0.00292     0.00033     0.00112     0.6703E-02   0.3075E-02  -0.3071E-03
   2  0.7703E-01     0.19490     0.01470     0.00231     0.00126     0.00026     0.00089    -0.1703E-03   0.1788E-02  -0.1311E-03
   3  0.3126E-01     0.24326     0.00749     0.00121     0.00059     0.00012     0.00035    -0.1201E-02   0.1320E-02   0.4924E-04
   4  0.5194E-01     0.28885     0.01489     0.00158     0.00100     0.00033     0.00096    -0.4675E-02   0.4065E-02   0.1205E-03
   5  0.4145E-01     0.33273     0.01372     0.00089     0.00113     0.0         0.0        -0.7390E-02   0.5485E-02  -0.7114E-04
   6  0.2252E 00     0.04841     0.01083     0.0         0.00130     0.0         0.0         0.6821E-02   0.2771E-03  -0.3344E-04
   7  0.8313E-02     0.00493     0.00000     0.00004     0.00000     0.0         0.0        -0.4939E-10  -0.2125E-04   0.3285E-04
   8  0.8265E-01     0.00264     0.00100    -0.00025     0.00009     0.0         0.0        -0.3387E-03   0.3213E-03  -0.4456E-04
   9  0.7138E-02     0.00597     0.00000     0.00004     0.00000     0.0         0.0        -0.2699E-11  -0.241[illegible]E-04   0.3802E-05
  10  0.7817E-01     0.00153     0.00052     0.00012     0.00005     0.0         0.0        -0.1211E-03   0.3259E-04   0.3226E-04
  11  0.1249E-01     0.14285     0.00000    -0.00178     0.00000     0.0         0.0        -0.1598E-08   0.5159E-03  -0.1083E-02
  12  0.1753E-01     0.03454     0.00060     0.0         0.00005     0.0         0.0        -0.8343E-03   0.6015E-04  -0.5263E-05
  13  0.3645E-02     0.01976     0.00000     0.00007     0.00000     0.0         0.0        -0.123[illegible]E-09  -0.3516E-04   0.8051E-04

       SREF          WSPAN          CBAR             CLTOT          CDTOT         CYTOT     CMTOT          CRMTOT        CYMTOT

    0.96768E 06   0.12901E 04   0.10223E 04        0.18220        0.01681        0.0      -0.24120E-02   0.0           0.0


CD/CL**2 = 0.5063    E = 0.3656
```

Figure C-11.- Portion of output from submittal to VORLAX

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# PROGRAM

# WAVE DRAG TO VORLAX
# INPUT CONVERSION PROGRAM
# (WDTVOR)

COMPLETE COMPILE
AND EXECUTION
IN IBM FORTRAN IV LEVEL H

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**LOCKHEED PROPRIETARY DATA**

```
        COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                           SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
                 CONTROL*VRLX.WDTVORN                                          9/21/76 00000010
                 C                                                                     00000020
                 C...THIS PROGRAM IS BASED ON NASA LRC PROGRAM D2500 -- WAVE DRAG      00000030
                 C                                                                     00000040
  ISN 0002             COMMON ABC (20) , J0, J1, J2, J3, J4, J5, J6, NWAF, NWAFOR, NFUS, 00000050
                      * NRADX  (4) , NFORX  (4) , NP, NPODOR, NF, NFINOR, NCAN, NCANOR,  00000060
                      * J2TEST, LERR, NRICH, REFA, NCASE, XMACH, NX, NTHETA, NREST,      00000070
                      * XREST (10), SKL                                                  00000080
  ISN 0003             COMMON/BLK2/V, XFUS1, XFUSN                                       00000090
  ISN 0004             COMMON/BLACK/XAF (30), WAFORG (20, 4), WAFORD (20, 3, 30),        00000100
                      * TZORD (20, 30), XFUS (30, 4), ZFUS (30, 4), SFUS (30, 30, 1),    00000110
                      * FUSARD (30, 4), FUSRAD (130, 4), PODORG (9, 3), XPOD (9, 30),    00000120
                      * PODORD (9, 30), NPTSPS (5), PDES (30, 30, 10), FINORG (6, 2, 4), 00000130
                      * XFIN (6, 10), FINORD (6, 2, 10), CANORG (2, 2, 4), XCAN (2, 10), 00000140
                      * CANORD (2, 2, 10), CANOR1 (2, 2, 10)                             00000150
                 C                                                                       00000160
  ISN 0005             DIMENSION ALPHA (7), YFUSMX (4, 30), AFUS (4, 29), XFPCT (50),    00000170
                      * ZC12 (50), RDFUS(50)                                             00000180
  ISN 0006             DIMENSION ABCD (20)                                               00000190
  ISN 0007             DIMENSION ZCP12 (9, 30), PHI (10)                                 00000200
                 C                                                                       00000210
  ISN 0008             DTR = .017453                                                     00000220
  ISN 0009             INTEGER FUSTYP                                                    00000230
                 C                                                                       00000240
  ISN 0010             DATA L3 /3/                                                       00000250
  ISN 0011             CALL LSTDT8                                                       00000260
  ISN 0012             FUSTYP = 0                                                        00000270
  ISN 0013             NSWVOR = 20                                                       00000280
                 C                                                                       00000290
                 C  READ NAMELIST CARDS                                                  00000300
                 C                                                                       00000310
  ISN 0014             NAMELIST /INPUT/FUSTYP, NSWVOR                                    00000320
  ISN 0015             READ (5, INPUT, END=760)                                          00000330
                 C                                                                       00000350
                 C   INPUT 1ST TWO CARDS (TITLE CARD & CONTROL FLAGS)                    00000360
                 C                                                                       00000370
  ISN 0016        10   FORMAT (20A4)                                                     00000380
  ISN 0017             READ (5, 10) ABC                                                  00000390
  ISN 0018        20   FORMAT (1H1, 20A4)                                                00000400
  ISN 0019             READ (5, 30) J0, J1, J2, J3, J4, J5, J6, NWAF, NWAFOR, NFUS,      00000410
```

```
                    * (NRADX (I), NFORX (I), I = 1, 4) , NP, NPODOR, NF, NFINOR,       00000420
                    * NCAN, NCANOR                                                     00000430
ISN 0020       30    FORMAT (24I3)                                                     00000440
              C                                                                        00000450
              C    INPUT CONFIGURATION DESCRIPTION AND INITIALIZE                      00000460
              C                                                                        00000470
ISN 0021             CALL START                                                        00000480
ISN 0022             NKODE = 0                                                         00000490
              C                                                                        00000500
              C          INPUT CASE CARD                                               00000510
              C                                                                        00000520
ISN 0023             READ (5, 40) NCASE, MACH, NX, NTHETA, NREST, NCON, NPLT           00000530
ISN 0024             KEY = 0                                                           00000540
ISN 0025       40    FORMAT (A4, 5I4, 8I1)                                             00000550
ISN 0026             XMACH = FLOAT (MACH) /1000.                                       00000560
ISN 0027             LERR = 0                                                          00000570
              C                                                                        00000580
              C          INPUT RESTRAINT POINTS                                        00000590
              C                                                                        00000600
ISN 0028             IF (.NOT. (NKODE .EQ. 0 .AND. NREST .NE. 0)) GO TO 70             00000610
ISN 0030             READ (5, 50) XREST                                                00000620
ISN 0031       50    FORMAT (10F7.0)                                                   00000630
ISN 0032             DO 60 I = 1, 10                                                   00000640
ISN 0033             XREST (I) = XREST (I) /SKL                                        00000650
ISN 0034       60    CONTINUE                                                          00000660
ISN 0035             NKODE = 1                                                         00000670
ISN 0036       70    CONTINUE                                                          00000680
              C                                                                        00000690
              C    IN  VORLAX SOME 19 CARDS ARE DESCRIBED. HOWEVER, THIS DOES NOT MEAN 00000700
              C    THAT INPUT FOR A CASE CONSISTS OF 19 CARDS.  RATHER THESE SHOULD BE 00000710
              C    THOUGHT OF AS "CARD TYPES."  FURTHERMORE, NOT ALL CARD TYPES WILL   00000720
              C    BE INCLUDED IN A GIVEN CASE,  THOSE TO BE INCLUDED OR DELETED       00000730
              C    BEING A FUNCTION OF SOME OF THE INPUT CONTROL VALUES.               00000740
              C                                                                        00000750
              C    THE FOLLOWING CARD NUMBERS ARE COMPATIBLE WITH THE VORLAX INPUT     00000760
              C    FORMAT AND A COMPLETE DESCRIPTION CAN BE FOUND IN THE VORLAX PROGRA00000770
              C    MANUAL LR 26299 SECTION 3.2.                                        00000780
              C                                                                        00000790
              C         START CONSTRUCTION OF VORLAX DATASET                           00000800
              C    PUTTING OUT TITLE CARD 1                                            00000810
              C                                                                        00000820
ISN 0037             WRITE (L3, 10) ABC                                                00000830
ISN 0038             WRITE (6, 20) ABC                                                 00000840
              C                                                                        00000850
              C    SETTING UP FOR CARD 2 (CONTROLS)                                    00000860
              C                                                                        00000870
ISN 0039             ISOLV = 0                                                         00000880
ISN 0040             LAX = 0                                                           00000890
ISN 0041             LAY = 1                                                           00000900
ISN 0042             REXPAR = -.02                                                     00000910
ISN 0043             HAG = 0.0                                                         00000920
ISN 0044             FLOATX = 0.0                                                      00000930
ISN 0045             FLOATY = 0.0                                                      00000940
ISN 0046             IBCON = 0                                                      00000950
ISN 0047             ITRMAX = 0                                                     00000960
ISN 0048             WRITE (L3, 500) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,   00000970
                    * IBCON, ITRMAX                                                 00000980
ISN 0049             WRITE (6, 510) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY,    00000990
                    * IBCON, ITRMAX                                                 00001000
               C                                                                    00001010
               C    SET UP FOR CARD 3 (MACH NUMBERS)                                00001020
               C                                                                    00001030
ISN 0050             NMACH = 1                                                      00001040
ISN 0051             WRITE (L3, 520) NMACH, XMACH                                   00001050
ISN 0052             WRITE (6, 530) NMACH, XMACH                                    00001060
               C                                                                    00001070
               C    SET UP FOR CARD 4 (ALPHA'S)                                     00001080
               C                                                                    00001090
ISN 0053             NALPHA = 3                                                     00001100
ISN 0054             ALPHA (1) = 0.                                                 00001110
ISN 0055             ALPHA (2) = 5.                                                 00001120
ISN 0056             ALPHA (3) = 10.                                                00001130
ISN 0057             WRITE (L3, 520) NALPHA, (ALPHA (I), I = 1, NALPHA)             00001140
ISN 0058             WRITE (6, 530) NALPHA, (ALPHA (I) , I = 1, NALPHA)             00001150
               C                                                                    00001160
               C    SET UP FOR CARD 5 (ASYMMETRIC CONTROLS)                         00001170
               C                                                                    00001180
ISN 0059             LATRAL = 0                                                     00001190
ISN 0060             PSI = 0                                                        00001200
ISN 0061             PITCHQ = 0                                                     00001210
ISN 0062             ROLLQ = 0                                                      00001220
ISN 0063             YAWQ = 0                                                       00001230
ISN 0064             VINF = 0                                                       00001240
ISN 0065             WRITE (L3, 520) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF         00001250
ISN 0066             WRITE (6, 530 ) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF         00001260
               C                                                                    00001270
               C    SET UP FOR CARD 6 (REFERENCE DIMENSIONS)                        00001280
               C                                                                    00001290
ISN 0067             NFUSP = 0                                                      00001300
ISN 0068             IF  (NFUS  .GT. 0) NFUSP = 1                                   00001310
ISN 0070             NPAN = NWAF - 1 + NF + NCAN + NFUSP + NP                       00001320
ISN 0071             SREF = REFA                                                    00001330
ISN 0072             CBAR = 1.0                                                     00001340
ISN 0073             XBAR = 0.                                                      00001350
ISN 0074             ZBAR = 0.                                                      00001360
ISN 0075             WSPAN = WAFORG (NWAF, 2) *2.0                                  00001370
ISN 0076             WRITE (L3, 540) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN            00001380
ISN 0077             WRITE (6, 550) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN             00001390
               C                                                                    00001400
               C    WING TREATMENT                                                  00001410
               C                                                                    00001420
               C    SET UP FOR CARDS 7 (COORDS. OF ONE SIDE OF MAJOR PANEL)         00001430
               C                                                                    00001440
ISN 0078             IF (J1 .EQ. 0) GO TO 110                                       00001450
ISN 0080             NWPAN = NWAF - 1                                               00001460
ISN 0081             DO 90 NN = 1, NWAF                                             00001470
ISN 0082           DO 80 II = 1, NWAFOR                                               00001480
ISN 0083           TZORD (NN, II) = TZORD (NN, II) /WAFORG (NN, 4) *100.              00001490
ISN 0084     80    CONTINUE                                                           00001500
ISN 0085     90    CONTINUE                                                           00001510
ISN 0086           DO 100 IT = 1, NWPAN                                               00001520
ISN 0087           WRITE (L2, 560) (WAFORG (IT, J), J = 1, 4), IT                     00001530
ISN 0088           WRITE (6, 570) (WAFORG (IT, J), J = 1, 4), IT                      00001540
            C                                                                         00001550
            C    SETTING UP FOR CARD 8 (COORDS. OF OTHER SIDE OF MAJOR WING PANEL)    00001560
            C                                                                         00001570
ISN 0089           WRITE (L3, 560) (WAFORG (IT + 1, J), J = 1, 4), IT                 00001580
ISN 0090           WRITE (6, 570) (WAFORG (IT + 1, J), J = 1, 4), IT                  00001590
            C                                                                         00001600
            C    SETTING UP FOR CARD 9 (WING SUB PANEL CONTROLS)                      00001610
            C                                                                         00001620
ISN 0091           TNVOR = 3.0                                                        00001630
ISN 0092           RNCV = 10.                                                         00001640
ISN 0093           SPC = 1.                                                           00001650
ISN 0094           CURV = 0.                                                          00001660
ISN 0095           WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                             00001670
ISN 0096           WRITE (6, 590 ) TNVOR, RNCV, SPC, CURV                             00001680
            C                                                                         00001690
            C    SETTING UP FOR CARD 11 (ADDITIONAL WING CONTROL PARAMETERS)          00001700
            C                                                                         00001710
ISN 0097           AINC1 = 0.                                                         00001720
ISN 0098           AINC2 = 0.                                                         00001730
ISN 0099           ITS = 0                                                            00001740
ISN 0100           NAP = NWAFOR                                                       00001750
ISN 0101           IQUANT = 0                                                         00001760
ISN 0102           ISYNT = 0                                                          00001770
ISN 0103           NPP = 0                                                            00001780
ISN 0104           WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP         00001790
ISN 0105           WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP          00001800
            C                                                                         00001810
            C    SETTING UP FOR CARD 14 (WING PER CENT CHORD STATIONS)                00001820
            C                                                                         00001830
ISN 0106           IF (NAP .EQ. 0) GO TO 110                                          00001840
ISN 0108           WRITE (L3, 620) (XAF (J), J = 1, NAP)                              00001850
ISN 0109           WRITE (6, 630 )  (XAF (J) , J = 1, NAP)                            00001860
            C                                                                         00001870
            C    SETTING UP FOR CARD 16 (WING CAMBER ORDINATES)                       00001880
            C                                                                         00001890
ISN 0110           WRITE (L3, 640) (TZORD (IT, JJ) , JJ = 1, NWAFOR)                  00001900
ISN 0111           WRITE (6, 650) (TZORD (IT, JJ) , JJ = 1, NWAFOR)                   00001910
ISN 0112           WRITE (L3, 640) (TZORD (IT + 1, JJ) , JJ = 1, NWAFOR)              00001920
ISN 0113           WRITE (6, 650) (TZORD (IT + 1, JJ) , JJ = 1, NWAFOR)               00001930
ISN 0114     100   CONTINUE                                                           00001940
            C                                                                         00001950
            C    FUSELAGE TREATMENT                                                   00001960
            C                                                                         00001970
ISN 0115     110   IF (J2  .EQ. 0) GO TO 380                                          00001980
            C                                                                         00001990
            C    J2TEST = 1 FUSELAGE IS CIRCULAR AND UNCAMBERED                       00002000
```

```
             C    J2TEST = 2 FUSELAGE IS CIRCULAR AND CAMBERED                        00002010
             C    J2TEST = 3 FUSELAGE IS ARBITRARY IN CROSS SECTION                   00002020
             C                                                                        00002030
ISN 0117            GO TO (230, 230, 120), J2TEST                                     00002040
             C                                                                        00002050
             C    TREATMENT OF ARBITRARY FUSELAGE SECTIONS                            00002060
             C    GETTING THE MAX Y VALUE AT EACH STATION                             00002070
             C                                                                        00002080
ISN 0118      120   DO 130 KI = 1, NFUS                                               00002090
ISN 0119            KISS = NFORX (KI)                                                 00002100
ISN 0120            KUSS = NRADX (KI)                                                 00002110
ISN 0121            DO 130 LN = 1, KISS                                               00002120
ISN 0122            DO 130 IC = 1, KUSS                                               00002130
ISN 0123            KEY = 2 *(KI - 1) + 1                                             00002140
ISN 0124            IF (IC  .EQ. 1) TEMP = 0.                                         00002150
ISN 0126            IF  (IC  .GT. 1) TEMP = YFUSMX (KI, LN)                           00002160
ISN 0128            IF  (IC  .EQ. NRADX (KI) ) GO TO 130                              00002170
ISN 0130            YFUSMX (KI, LN) = AMAX1 (SFUS (IC, LN, KEY), TEMP)                00002180
ISN 0131      130   CONTINUE                                                          00002190
             C                                                                        00002200
             C GETTING THE INCREMENTAL FUSELAGE PLANFORM AREAS                        00002210
             C                                                                        00002220
ISN 0132      140   DO 160 KI = 1, NFUS                                               00002230
ISN 0133            KISS = NFORX (KI) - 1                                             00002240
ISN 0134            DO 150 LN = 1, KISS                                               00002250
ISN 0135            AFUS (KI, LN) = (YFUSMX (KI, LN + 1) + YFUSMX (KI, LN))           00002260
                  * *(XFUS (LN + 1, KI) - XFUS (LN, KI)) /2.0                         00002270
ISN 0136      150   CONTINUE                                                          00002280
ISN 0137      160   CONTINUE                                                          00002290
             C                                                                        00002300
             C   SOLVING FOR ZERO THICKNESS FUSELAGE PANEL COORDINATES                 00002310
             C                                                                        00002320
ISN 0138            XMID = WAFORG (1, 1) + WAFORG (1, 4) /2.0                         00002330
ISN 0139            DO 180 KI = 1, NFUS                                               00002340
ISN 0140            KISS = NFORX (KI)                                                 00002350
ISN 0141            DO 170 LN = 1, KISS                                               00002360
ISN 0142            DXMID = XMID - XFUS (LN, KI)                                      00002370
ISN 0143            IF (DXMID .LE. 0.) GO TO 190                                      00002380
ISN 0145      170   CONTINUE                                                          00002390
ISN 0146      180   CONTINUE                                                          00002400
ISN 0147      190   KIMID = KI                                                        00002410
ISN 0148            LNMID = LN                                                        00002420
ISN 0149            XDIV = XFUS (LNMID, KIMID)                                        00002430
             C                                                                        00002440
             C    INTEGRATE AREAS OF FWD FUSELAGE                                     00002450
             C                                                                        00002460
ISN 0150            A1 = 0.                                                           00002470
ISN 0151            DO 200 KI = 1, KIMID                                              00002480
ISN 0152            KISS = NFORX (KI) -1                                              00002490
ISN 0153            IF  (KI  .EQ. KIMID) KISS = LNMID -1                              00002500
ISN 0155            DO 200 LN = 1, KISS                                               00002510
ISN 0156            A1 = A1 + AFUS (KI, LN)                                           00002520
ISN 0157      200   CONTINUE                                                          00002530
ISN 0158          DX1 = 2.0 *A1 /WAFORG (1, 2) - (XDIV - XFUS (1, 1))                00002540
ISN 0159          XONE = XDIV - DX1                                                  00002550
            C                                                                        00002560
            C    INTEGRATE AREAS OF AFT FUSELAGE PLANFORM                            00002570
            C                                                                        00002580
ISN 0160          A2 = 0.                                                            00002590
ISN 0161          DO 220 KI = KIMID, NFUS                                            00002600
ISN 0162          KISS = NFORX (KI) -1                                               00002610
ISN 0163          DO 210 LN = LNMID, KISS                                            00002620
ISN 0164          A2 = A2 + AFUS (KI, LN)                                            00002630
ISN 0165      210 CONTINUE                                                           00002640
ISN 0166      220 CONTINUE                                                           00002650
ISN 0167          DX2 = 2.0 *A2 /WAFORG (1, 2) - YFUS (NFORX (NFUS), NFUS) + XDIV    00002660
ISN 0168          XFUSS1 = XFUS (1, 1)                                               00002670
ISN 0169          YFUSS1 = YFUSMX (1, 1)                                             00002680
ISN 0170          ZFUSS = WAFORG (1, 3)                                              00002690
ISN 0171          CORDF1 = XFUS (NFORX (NFUS), NFUS) - XFUS (1, 1)                   00002700
ISN 0172          XFUSS2 = XONE                                                      00002710
ISN 0173          YFUSS2 = WAFORG (1, 2)                                             00002720
ISN 0174          CORDF2 = DX1 + DX2                                                 00002730
            C                                                                        00002740
            C    CARD 7 OF FUSELAGE PANEL (COORDS. OF FUSELAGE PANEL CENTER LINE)    00002750
            C                                                                        00002760
ISN 0175          WRITE (L3, 720) XFUSS1, YFUSS1, ZFUSS, CORDF1                      00002770
ISN 0176          WRITE (6, 730) XFUSS1, YFUSS1, ZFUSS, CORDF1                       00002780
            C                                                                        00002790
            C    CARD 8 OF FUSELAGE PANEL (COORDS. OF FUSE. PANEL AT WING JUNCTURE)  00002800
            C                                                                        00002810
ISN 0177          WRITE (L3, 720) XFUSS2, YFUSS2, ZFUSS, CORDF2                      00002820
ISN 0178          WRITE (6, 730) XFUSS2, YFUSS2, ZFUSS, CORDF2                       00002830
            C                                                                        00002840
            C    CARD 9 OF FUSELAGE (SUB PANELLING CONTROLS)                         00002850
            C                                                                        00002860
ISN 0179          TNVOR = 3.                                                         00002870
ISN 0180          RNCV = 2.0                                                         00002880
ISN 0181          SPC = 1.                                                           00002890
ISN 0182          CURV = 0.                                                          00002900
ISN 0183          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                             00002910
ISN 0184          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                              00002920
            C                                                                        00002930
            C    SET UP FOR CARD 11 (ADDITIONAL CONTROL PARAMETERS FOR FUSELAGE)     00002940
            C                                                                        00002950
ISN 0185          AINC1 = 0.                                                         00002960
ISN 0186          AINC2 = 0.                                                         00002970
ISN 0187          JITS = 0                                                           00002980
ISN 0188          NAP = 0                                                            00002990
ISN 0189          IF (J2TEST .EQ .2) NAP=NFORX(1)+NFORX(2)+NFORX(3)+NFORX(4)-NFUS+1  00003000
ISN 0191          IQUANT = 0                                                         00003010
ISN 0192          ISYNT = 0                                                          00003020
ISN 0193          NPP = 0                                                            00003030
ISN 0194          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP         00003040
ISN 0195          WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP          00003050
ISN 0196          IF (NAP .NE. 0) GO TO 360                                          00003060
```

```
               C                                                                   00003070
               C                                                                   00003080
ISN 0198              GO TO 380                                                    00003090
               C                                                                   00003100
               C    START OF CIRCULAR FUSELAGE TREATMENT                           00003110
               C                                                                   00003120
ISN 0199        230  DO 240 KI = 1, NFUS                                           00003130
ISN 0200              KISS = NFORX (KI)                                            00003140
ISN 0201              DO 240 LN = 1, KISS                                          00003150
ISN 0202              YFUSMX (KI, LN) = FUSRAD (LN, KI)                            00003160
ISN 0203        240  CONTINUE                                                      00003170
               C                                                                   00003180
               C    IF CIRCULAR FUSELAGE IS CAMBERED THEN GO TO GET FUSE. CAMBER ORDS. 00003190
               C                                                                   00003200
ISN 0204              IF (FUSTYP .EQ. 1) GO TO 250                                 00003210
ISN 0206              GO TO (140, 340, 140), J2TEST                                00003220
               C                                                                   00003230
               C    BEGIN HEXAGONAL FUSELAGE TREATMENT                             00003240
               C                                                                   00003250
ISN 0207        250  XFUSS1 = XFUS (1, 1)                                          00003260
               C                                                                   00003270
               C    DETERMINE WHICH TWO FUSE STNS BRACKET X OF WING ROOT L E       00003280
               C                                                                   00003290
ISN 0208              DO 260 KI = 1, NFUS                                          00003300
ISN 0209              KISS = NFORX (KI)                                            00003310
ISN 0210              DO 260  LN = 1, KISS                                         00003320
ISN 0211              DXWLE = WAFORG (1,1) - XFUS (LN, KI)                         00003330
ISN 0212              IF (DXWLE .LE. 0) GO TO 270                                  00003340
ISN 0214        260  CONTINUE                                                      00003350
ISN 0215        270  XAFT = XFUS (LN, KI)                                          00003360
ISN 0216              IF (LN .GT.1) XFWD = XFUS (LN- 1, KI)                        00003370
ISN 0218              IF (LN .EQ. 1) XFWD = XFUS (KISS, KI - 1)                    00003380
               C                                                                   00003390
               C  DETERMINE FUSELAGE CAMBER AT WING ROOT L E                        00003400
               C                                                                   00003410
ISN 0220              ZAFT = ZFUS (LN, KI)                                         00003420
ISN 0221              IF (LN .GT. 1) ZFWD = ZFUS (LN - 1, KI)                      00003430
ISN 0223              IF (LN. EQ. 1) ZFWD = ZFUS (KISS, KI - 1)                    00003440
ISN 0225              SLOPE = (ZAFT - ZFWD) /(XAFT - XFWD)                         00003450
ISN 0226              ZFWLE = ZFWD + (WAFORG (1,1) - XFWD) *SLOPE                  00003460
               C                                                                   00003470
               C    DETERMINE PHI & RHO FROM FUSE C-LINE TO WING L E ROOT          00003480
               C                                                                   00003490
ISN 0227              RHOREF  = SQRT ((WAFORG (1,3) - ZFWLE) **2 + WAFORG (1,2) **2) 00003500
ISN 0228              PHIREF = ATAN ((WAFORG (1,3) - ZFWLE) /WAFORG (1,2)) /DTR    00003510
               C                                                                   00003520
               C    SET UP CARDS 7 & 8 OF HEXAGONAL FUSELAGE                       00003530
               C                                                                   00003540
ISN 0229              XFUSS1 = XFUS (1,1)                                          00003550
ISN 0230              YFUSS1 = 0.                                                  00003560
ISN 0231              ZFUSS1 = ZFWLE + RHOREF                                      00003570
ISN 0232                ZFUSS2=ZFWLE-RHOREF                                        00003572
ISN 0233              CORDF1 = XFUS (NFORX (NFUS), NFUS) - XFUS (1,1)              00003580
```

```
C
C CARD 7 & 8 OF HEXAGONAL FUSELAGE
C
      WRITE (L3,720) XFUSS1, YFUSS1, ZFUSS1, CORDF1
      WRITE (6,730) XFUSS1, YFUSS1, ZFUSS1, CORDF1
       WRITE (L3,720) XFUSS1, YFUSS1, ZFUSS2, CORDF1
       WRITE (6,730)  XFUSS1, YFUSS1, ZFUSS2, CORDF1
C
C   CARD 9 (SUB PANEL CONTROLS OF HEXAGONAL FUSELAGE)
C
      TNVOR = 3
      RNCV = NFORX (1) + NFORX (2) + NFORX (3) + NFORX (4) - NFUS
      SPC = 1.0
      CURV = 999.
      WRITE (L3, 580) TNVOR, RNCV, SPC, CURV
      WRITE(6, 590) TNVOR, RNCV, SPC, CURV
C
C   SET UP POLAR COORDINATES FOR REFERENCE HEXAGON
C
      DUPER = 90 - PHIREF
      PANUP = DUPER /60.
      IPANUP = PANUP + .5
      DPHEU = DUPER /IPANUP
      DPHLD = (180 - DUPER) /(3 - IPANUP)
      DO 290 JK=1,4
      IF (JK .LE. IPANUP) PHI (JK) = 90 - (JK -1) *DPHEU
      IF (JK .GT. IPANUP) PHI (JK) = 90-IPANUP*DPHEU-DPHLD*(JK-1-IPANUP)
 290  CONTINUE
      WRITE (L3, 620) ((PHI (JK), RHOREF), JK = 1, 4)
      WRITE (6, 630) ((PHI(JK), RHOREF), JK = 1, 4)
C
C  SET UP FOR CARD 11 OF HEXAGONAL FUSE.(ADDITIONAL CONTROL PARAMETERS)
C
      AINC1 = 0.
      AINC1 = 0.
      ITS = 1
      NAP = RNCV + 1
      IF (J2TEST .EQ. 1) NAP = 0
      IQUANT = 0
      ISYNT = 0
      NPP = 1
      WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP
      WRITE(6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP
      IF (NAP .EQ. 0) GO TO 380
C
C   CARD 14 OF HEXAGONAL FUSELAGE(PERCENT LENGTH STATION OF FUSELAGE)
C
      JJ = 1
      DO 310 KI = 1, NFUS
      KISS = NFORX (KI) -1
      IF (KI .EQ. NFUS) KISS = NFORX (NFUS)
      DO 300 LN = 1, KISS
      XFPCT (JJ) = XFUS (LN, KI) /(XFUSN - XFUS1) *100.
```

```
ISN 0277            ZC12 (JJ) = ZFUS (LN, KI)/(XFUSN-XFUS1)*100.                  00004120
ISN 0278            ROFUS (JJ) = FUSRAD (LN, KI)                                  00004130
ISN 0279            JJ = JJ + 1                                                   00004140
ISN 0280       300  CONTINUE                                                      00004150
ISN 0281       310  CONTINUE                                                      00004160
ISN 0282            DO 320 JJ = 1, NAP                                            00004170
ISN 0283            IF ((XFPCT(JJ+1)*(XFUSN-XFUS1)/100.) .GT. WAFORG (1,1) .AND.  00004180
                  * (XFPCT(JJ-1)*(XFUSN-XFUS1)/100.) .LT.                         00004190
                  * (WAFORG (1,1) + WAFORG (1,4))) ROFUS (JJ) = RHOREF            00004200
ISN 0285       320  CONTINUE                                                      00004210
ISN 0286            WRITE (L3, 620) (XFPCT (J), J = 1, NAP)                       00004220
ISN 0287            WRITE (6,630) (XFPCT (J), J = 1,NAP)                          00004230
              C                                                                   00004240
              C   SETTING UP FOR CARD 16 OF HEXAGONAL FUSELAGE (AREA  RATIOS WRT. 00004250
              C   REFERENCE HEXAGON)                                              00004260
              C                                                                   00004270
ISN 0288            DO 330 LL = 1, NAP                                            00004280
ISN 0289            ROFUS (LL) = (ROFUS (LL) /RHOREF) **2 *100.                   00004290
ISN 0290       330  CONTINUE                                                      00004300
ISN 0291            WRITE (L3, 620) (ZC12 (JJ), JJ = 1, NAP)                      00004310
ISN 0292            WRITE (6, 630) (ZC1 2(JJ), JJ = 1, NAP)                       00004320
ISN 0293            WRITE (L3, 620) (ROFUS (LL), LL = 1, NAP)                     00004330
ISN 0294            WRITE (6, 630) (ROFUS (LL), LL = 1, NAP)                      00004340
ISN 0295            GO TO 380                                                     00004350
              C                                                                   00004360
              C   SET UP FOR CARDS 14, 16, 18 OF ZERO THICKNESS FUSELAGE TREATMENT 00004370
              C                                                                   00004380
ISN 0296       340  JJ = 1                                                        00004390
ISN 0297            DO 350 KI = 1, NFUS                                           00004400
ISN 0298            KISS = NFORX (KI) -1                                          00004410
ISN 0299            IF (KI .EQ. NFUS) KISS = NFORX (NFUS)                         00004420
ISN 0301            DO 350 LN = 1, KISS                                           00004430
ISN 0302            XFPCT (JJ) = XFUS (LN, KI) /(XFUSN - XFUS1) *100.             00004440
ISN 0303            ZC12(JJ)=(ZFUS(LN,KI)-(ZFUS(1,1)-WAFORG(1,3)))/(XFUSN-XFUS1)*100. 00004450
ISN 0304            JJ = JJ + 1                                                   00004460
ISN 0305       350  CONTINUE                                                      00004470
ISN 0306            GO TO 140                                                     00004480
ISN 0307       360  WRITE (L3, 620) (XFPCT (J), J = 1, NAP)                       00004490
ISN 0308            WRITE (6, 630) (XFPCT (J), J = 1, NAP)                        00004500
ISN 0309            DO 370 I = 1, 2                                               00004510
ISN 0310            WRITE (L3, 620) (ZC12 (J), J = 1, NAP)                        00004520
ISN 0311            WRITE (6, 630) (ZC12 (J), J = 1, NAP)                         00004530
ISN 0312       370  CONTINUE                                                      00004540
              C                                                                   00004550
              C     NACELLE TREATMENT                                             00004560
              C   SETTING UP FOR CARD 7 & 8                                       00004570
              C                                                                   00004580
ISN 0313       380  IF (J3 .EQ. 0) GO TO 450                                      00004590
ISN 0315            DO 440 JJ = 1, NP                                             00004600
ISN 0316            X1 = PODORG (JJ, 1)                                           00004610
ISN 0317            Y1 = PODORG (JJ, 2)                                           00004620
ISN 0318            Z1 = PODORG (JJ, 3) + PODORD (JJ, 1)                          00004630
ISN 0319            CORD1 = XPOD (JJ, NPODOR) - XPOD (JJ, 1)                      00004640
ISN 0320          DO 390 KK = 1, 2                                              00004650
ISN 0321          WRITE (L3, 740 ) X1, Y1, Z1, CORD1, JJ                        00004660
ISN 0322          WRITE (6, 750 ) X1, Y1, Z1, CORD1, JJ                         00004670
ISN 0323     390  CONTINUE                                                      00004680
            C                                                                   00004690
            C  SETTING UP FOR NACELLE CARD 9                                    00004700
            C                                                                   00004710
ISN 0324          TNVOR = 6                                                     00004720
ISN 0325          RNCV = NPODOR -1                                              00004730
ISN 0326          IF (RNCV .LT. 5) RNCV = 5                                     00004740
ISN 0328          SPC = 0.                                                      00004750
ISN 0329          CURV = 999.                                                   00004760
ISN 0330          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                        00004770
ISN 0331          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                         00004780
            C                                                                   00004790
            C    SET UP FOR NACELLE CARD 10 (POLAR COORDS. OF CURVED PANELS)    00004800
            C                                                                   00004810
ISN 0332          DO 400 JK = 1, 7                                              00004820
ISN 0333          PHI (JK) = 90. - (JK -1) *60.                                 00004830
ISN 0334          RHO = PODORD (JJ, 1)                                          00004840
ISN 0335     400  CONTINUE                                                      00004850
ISN 0336          WRITE (L3, 620) ((PHI (JK), RHO), JK = 1, 7)                  00004860
ISN 0337          WRITE (6, 630) ((PHI (JK), RHO), JK = 1, 7)                   00004870
            C                                                                   00004880
            C    SET UP FOR CARD 11 (ADDITIONAL CONTROL PARAMETERS)             00004890
            C                                                                   00004900
ISN 0338          AINC1 = 0.                                                    00004910
ISN 0339          AINC2 = 0.                                                    00004920
ISN 0340          ITS = 0                                                       00004930
ISN 0341          NAP = NPODOR                                                  00004940
ISN 0342          IQUANT = 0                                                    00004950
ISN 0343          ISYNT = 0                                                     00004960
ISN 0344          NPP = 2                                                       00004970
ISN 0345          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP    00004980
ISN 0346          WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP     00004990
            C                                                                   00005000
            C    SET UP FOR NACELLE CARD 14 (PERCENT LENGTH STATIONS)           00005010
            C                                                                   00005020
ISN 0347          DO 410 LL = 1, NAP                                            00005030
ISN 0348          XAF (LL) = ((XPOD (JJ, LL) - XPOD (JJ, 1)) /(XPOD (JJ, NAP)   00005040
                 *  - XPOD (JJ, 1))) **2 *100.                                  00005050
ISN 0349     410  CONTINUE                                                      00005060
ISN 0350          WRITE (L3, 620) (XAF (J), J = 1, NAP)                         00005070
ISN 0351          WRITE (6, 630) (XAF (J), J = 1, NAP)                          00005080
            C                                                                   00005090
            C    SETTING UP FOR NACELLE CARD 16 & 18 (PERCENT OF REFERENCE HEXAGON) 00005100
            C                                                                   00005110
ISN 0352          DO 420 LL = 1, NAP                                            00005120
ISN 0353          ZCP12 (JJ, LL) = PODORD (JJ, LL) /PODORD (JJ, 1) *100.        00005130
ISN 0354     420  CONTINUE                                                      00005140
ISN 0355          ZERO = 0.                                                     00005150
ISN 0356          WRITE (L3, 620) (ZERO)                                        00005160
ISN 0357          WRITE (6, 620) (ZERO)                                         00005170
ISN 0358          WRITE (L3, 620) (ZCP12 (JJ, LL), LL = 1, NAP)                    00005180
ISN 0359          WRITE (6, 630) (ZCP12 (JJ, LL), LL = 1, NAP)                     00005190
ISN 0360     440  CONTINUE                                                         00005200
             C                                                                     00005210
             C      FINS TREATMENT                                                 00005220
             C                                                                     00005230
             C    SET FOR CARDS 7 & 8 (BOTH SIDES OF MAJOR PANEL)                  00005240
             C                                                                     00005250
ISN 0361     450  IF  (J4  .EQ. 0) GO TO 470                                       00005260
ISN 0363          DO 460 NN = 1, NF                                                00005270
ISN 0364          WRITE (L3, 660) ((FINORG (NN, I, J), J = 1, 4), NN, I = 1, 2)    00005280
ISN 0365          WRITE (6, 670) ((FINORG (NN, I, J), J = 1, 4), NN, I = 1, 2)     00005290
             C                                                                     00005300
             C    SETTING UP FOR CARD 9 (SUB PANEL CONTROLS)                       00005310
             C                                                                     00005320
ISN 0366          TNVOR = 2.0                                                      00005330
ISN 0367          RNCV = 10.                                                       00005340
ISN 0368          SPC = 1.                                                         00005350
ISN 0369          CURV = 0.                                                        00005360
ISN 0370          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                           00005370
ISN 0371          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                            00005380
             C                                                                     00005390
             C    SETTING UP FOR CARD 11 (ADDITIONAL CONTROL PANEL FOR FINS)       00005400
             C                                                                     00005410
ISN 0372          AINC1 = 0.                                                       00005420
ISN 0373          AINC2 = 0.                                                       00005430
ISN 0374          ITS = 0                                                          00005440
ISN 0375          NAP = 0                                                          00005450
ISN 0376          IQUANT = 0                                                       00005460
ISN 0377          ISYNT = 0                                                        00005470
ISN 0378          NPP = 0                                                          00005480
ISN 0379          WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP       00005490
ISN 0380          WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP        00005500
ISN 0381     460  CONTINUE                                                         00005510
ISN 0382     470  IF (J5 .EQ. 0) GO TO 490                                         00005520
             C                                                                     00005530
             C    SETUP FOR CANARDS                                                00005540
             C                                                                     00005550
             C    SET UP FOR CARDS 7 & 8 (BOTH SIDES OF MAJOR PANELS)              00005560
             C                                                                     00005570
ISN 0384          DO 480 NN = 1, NCAN                                              00005580
ISN 0385          WRITE (L3, 680) ((CANORG (NN, I, J), J = 1, 4), NN, I = 1, 2)    00005590
ISN 0386          WRITE (6, 690) ((CANORG (NN, I, J), J = 1, 4), NN, I = 1, 2)     00005600
             C                                                                     00005610
             C    SETTING UP FOR CARD 9 (SUB PANEL CONTROLS)                       00005620
             C                                                                     00005630
ISN 0387          TNVOR = 2.0                                                      00005640
ISN 0388          RNCV = 10.                                                       00005650
ISN 0389          SPC = 1.                                                         00005660
ISN 0390          CURV = 0.                                                        00005670
ISN 0391          WRITE (L3, 580) TNVOR, RNCV, SPC, CURV                           00005680
ISN 0392          WRITE (6, 590) TNVOR, RNCV, SPC, CURV                            00005690
             C                                                                     00005700
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                 C    SETTING UP FOR CARD 11 (ADDITIONAL CONTROL PANELS FOR CANARDS)     00005710
                 C                                                                       00005720
ISN 0393                AINC1 = 0.                                                       00005730
ISN 0394                AINC2 = 0.                                                       00005740
ISN 0395                ITS = 0                                                          00005750
ISN 0396                NAP = 0                                                          00005760
ISN 0397                IQUANT = 0                                                       00005770
ISN 0398                ISYNT = 0                                                        00005780
ISN 0399                WRITE (L3, 600) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP       00005790
ISN 0400                WRITE (6, 610) AINC1, AINC2, ITS, NAP, IQUANT, ISYNT, NPP        00005800
ISN 0401          480   CONTINUE                                                         00005810
ISN 0402          490   NXS = 0                                                          00005820
ISN 0403                NYS = 0                                                          00005830
ISN 0404                NZS = 0                                                          00005840
ISN 0405                WRITE (L3, 700) NXS, NYS, NZS                                    00005850
ISN 0406                WRITE (6, 710) NXS, NYS, NZS                                     00005860
ISN 0407          500   FORMAT (3 (I2, 8X), 4F10.4, I2, 5X, I3)                          00005870
ISN 0408          510   FORMAT (1H , 3 (I2, 8X) , 4F10.4, I2, 5X, I3)                    00005880
ISN 0409          520   FORMAT (I2, 8X, 7F10.3)                                          00005890
ISN 0410          530   FORMAT (1H , I2, 8X, 7F10.3)                                     00005900
ISN 0411          540   FORMAT (I2, 8X, F10.2, 4F10.4)                                   00005910
ISN 0412          550   FORMAT (1H , I2, 8X, F10.2, 4F10.4)                              00005920
ISN 0413          560   FORMAT (4F10.4, 10X, 'WING PANEL NO.', I2)                       00005930
ISN 0414          570   FORMAT (1H , 4F10.4, 10X, 14HWING PANEL NO., I2)                 00005940
ISN 0415          580   FORMAT (4F10.4, 10X, 17HNVOR,RNCV,SPC,PDL)                       00005950
ISN 0416          590   FORMAT (1H , 4F10.4, 10X, 17HNVOR,RNCV,SPC,PDL)                  00005960
ISN 0417          600   FORMAT (2F10.4, 5 (I2, 8X))                                      00005970
ISN 0418          610   FORMAT (1H , 2F10.4, 5 (I2, 8X))                                 00005980
ISN 0419          620   FORMAT (8F10.4)                                                  00005990
ISN 0420          630   FORMAT (1H , 8F10.4)                                             00006000
ISN 0421          640   FORMAT (8F10.4)                                                  00006010
ISN 0422          650   FORMAT (1H , 8F10.4)                                             00006020
ISN 0423          660   FORMAT (4F10.4, 10X, 13HFIN PANEL NO., I2)                       00006030
ISN 0424          670   FORMAT (1H , 4F10.4, 10X, 13HFIN PANEL NO., I2)                  00006040
ISN 0425          680   FORMAT (4F10.4, 10X, 16HCANARD PANEL NO., I2)                    00006050
ISN 0426          690   FORMAT (1H , 4F10.4, 10X,16HCANARD PANEL NO., I2)                00006060
ISN 0427          700   FORMAT (3 (I2, 8X) , 10X, 11HNXS,NYS,NZS)                        00006070
ISN 0428          710   FORMAT (1X, 3 (I2, 8X) , 10X, 11HNXS,NYS,NZS)                    00006080
ISN 0429          720   FORMAT (4F10.4, 10X, 14HFUSELAGE PANEL)                          00006090
ISN 0430          730   FORMAT (1H , 4F10.4, 10X, 14HFUSELAGE PANEL)                     00006100
ISN 0431          740   FORMAT (4F10.4, 10X, 16HNACELLE PANEL NO, I2)                    00006110
ISN 0432          750   FORMAT (1H , 4F10.4, 10X, 16HNACELLE PANEL NO, I2)               00006120
ISN 0433          760   STOP                                                             00006130
ISN 0434                END                                                              00006140
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                 *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****            PAGE 013

SYMBOL  INTERNAL STATEMENT NUMBERS
I       0019 0019 0019 0019 0032 0033 0033 0057 0057 0057 0058 0058 0058 0309 0364 0364 0364 0365 0365
        0365 0385 0385 0385 0386 0386 0386
J       0087 0087 0087 0088 0088 0088 0089 0089 0089 0090 0090 0090 0108 0108 0108 0109 0109 0109 0286
        0286 0286 0287 0287 0287 0307 0307 0307 0308 0308 0308 0310 0310 0310 0311 0311 0311 0350 0350
        0350 0351 0351 0351 0364 0364 0364 0365 0365 0365 0385 0385 0385 0386 0386 0386
V       0003
A1      0150 0156 0156 0158
A2      0160 0164 0164 0167
IC      0122 0124 0126 0128 0130
I1      0082 0083 0083
IT      0086 0087 0087 0088 0088 0089 0089 0090 0090 0110 0111 0112 0113
JJ      0110 0110 0110 0111 0111 0111 0112 0112 0112 0113 0113 0113 0270 0276 0277 0278 0279 0279 0282
        0283 0283 0283 0291 0291 0291 0292 0292 0292 0296 0302 0303 0304 0304 0315 0316 0317 0318 0318
        0319 0319 0321 0322 0334 0348 0348 0348 0348 0353 0353 0353 0358 0359
JK      0249 0250 0250 0250 0252 0252 0252 0255 0255 0255 0256 0256 0256 0332 0333 0333 0336 0336 0336
        0337 0337 0337
J0      0002 0019
J1      0002 0019 0078
J2      0002 0019 0115
J3      0002 0019 0313
J4      0002 0019 0361
J5      0002 0019 0382
J6      0002 0019
KI      0118 0119 0120 0123 0126 0128 0130 0132 0133 0135 0135 0135 0135 0135 0139 0140 0142 0147 0151
        0152 0153 0156 0161 0162 0164 0199 0200 0202 0202 0208 0209 0211 0215 0216 0218 0220 0221 0223
        0271 0272 0273 0276 0277 0278 0297 0298 0299 0302 0303
KK      0320
LL      0288 0289 0289 0293 0293 0293 0294 0294 0294 0347 0348 0348 0352 0353 0353 0358 0358 0358 0359
        0359 0359
LN      0121 0126 0130 0130 0134 0135 0135 0135 0135 0135 0141 0142 0148 0155 0156 0163 0164 0201 0202
        0202 0210 0211 0215 0216 0216 0218 0220 0221 0221 0223 0275 0276 0277 0278 0301 0302 0303
L3      0010 0037 0048 0051 0057 0065 0076 0087 0089 0095 0104 0108 0110 0112 0175 0177 0183 0194 0234
        0236 0242 0255 0266 0286 0291 0293 0307 0310 0321 0330 0336 0345 0350 0356 0358 0364 0370 0379
        0385 0391 0399 0405
NF      0002 0019 0070 0363
NN      0081 0083 0083 0083 0363 0364 0364 0365 0365 0384 0385 0385 0386 0386
NP      0002 0019 0070 0315
NX      0002 0023
X1      0316 0321 0322
Y1      0317 0321 0322
Z1      0318 0321 0322
ABC     0002 0017 0037 0038
DTR     0008 0228
DX1     0158 0159 0174
DX2     0167 0174
HAG     0043 0048 0049
ITS     0099 0104 0105 0194 0195 0259 0266 0267 0340 0345 0346 0374 0379 0380 0395 0399 0400
KEY     0024 0123 0130
LAX     0040 0048 0049
LAY     0041 0048 0049
NAP     0100 0104 0105 0106 0108 0109 0188 0189 0194 0195 0196 0260 0261 0266 0267 0268 0282 0286 0287
        0288 0291 0292 0293 0294 0307 0308 0310 0311 0341 0345 0346 0347 0348 0350 0351 0352 0358 0359
```

```
                         *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
        0375 0379 0380 0396 0399 0400
NPP     0103 0104 0105 0193 0194 0195 0265 0266 0267 0344 0345 0346 0378 0379 0380 0399 0400
NXS     0402 0405 0406
NYS     0403 0405 0406
NZS     0404 0405 0406
PHI     0007 0250 0252 0255 0256 0333 0336 0337
PSI     0060 0065 0066
RHO     0334 0336 0337
SKL     0002 0033
SPC     0093 0095 0096 0181 0183 0184 0240 0242 0243 0328 0330 0331 0368 0370 0371 0389 0391 0392
XAF     0004 0108 0109 0348 0350 0351
ABCD    0006
AFUS    0005 0135 0156 0164
ATAN    0228
CBAR    0072 0076 0077
CURV    0094 0095 0096 0182 0183 0184 0241 0242 0243 0329 0330 0331 0369 0370 0371 0390 0391 0392
JITS    0187
KISS    0119 0121 0133 0134 0140 0141 0152 0153 0155 0162 0163 0200 0201 0209 0210 0218 0223 0272 0273
        0275 0298 0299 0301
KUSS    0120 0122
LERR    0002 0027
MACH    0023 0026
NCAN    0002 0019 0070 0384
NCON    0023
NFUS    0002 0019 0068 0118 0132 0139 0161 0167 0167 0171 0171 0189 0199 0208 0233 0233 0239 0271 0273
        0273 0297 0299 0299
NPAN    0070 0076 0077
NPLT    0023
NWAF    0002 0019 0070 0075 0080 0081
PDES    0004
REFA    0002 0071
RNCV    0092 0095 0096 0180 0183 0184 0239 0242 0243 0260 0325 0326 0326 0330 0331 0367 0370 0371 0388
        0391 0392
SFUS    0004 0130
SQRT    0227
SREF    0071 0076 0077
TEMP    0124 0126 0130
VINF    0064 0065 0066
XAFT    0215 0225
XBAR    0073 0076 0077
XCAN    0004
XDIV    0149 0158 0159 0167
XFIN    0004
XFUS    0004 0135 0135 0142 0149 0158 0167 0168 0171 0171 0207 0211 0215 0216 0218 0229 0233 0233 0276
        0302
XFWD    0216 0218 0225 0226
XMID    0138 0142
XONE    0159 0172
XPOD    0004 0319 0319 0348 0348 0348 0348
YAWQ    0063 0065 0066
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
ZAFT    0220  0225
ZBAR    0074  0076  0077
ZC12    0005  0277  0291  0292  0303  0310  0311
ZERO    0355  0356  0357
ZFUS    0004  0220  0221  0223  0277  0303  0303
ZFWD    0221  0223  0225  0226
AINC1   0097  0104  0105  0185  0194  0195  0257  0258  0266  0267  0338  0345  0346  0372  0379  0380  0393  0399  0400
AINC2   0098  0104  0105  0186  0194  0195  0266  0267  0339  0345  0346  0373  0379  0380  0394  0399  0400
ALPHA   0005  0054  0055  0056  0057  0058
AMAX1   0130
COPD1   0319  0321  0322
DPHEU   0247  0250  0252
DPHLO   0248  0252
DUPER   0244  0245  0247  0248
DXMID   0142  0143
DXWLE   0211  0212
FLOAT   0026
IBCON   0046  0048  0049
INPUT   0014  0015
ISOLV   0039  0048  0049
ISYNT   0102  0104  0105  0192  0194  0195  0264  0266  0267  0343  0345  0346  0377  0379  0380  0398  0399  0400
KIMID   0147  0149  0151  0153  0161
LNMID   0148  0149  0153  0163
NCASE   0002  0023
NFORX   0002  0019  0119  0133  0140  0152  0162  0167  0171  0189  0189  0189  0189  0200  0209  0233  0239  0239  0239
        0239  0272  0273  0298  0299
NFUSP   0067  0068  0070
NKODE   0022  0028  0035
NMACH   0050  0051  0052
NRADX   0002  0019  0120  0128
NREST   0002  0023  0028
NRICH   0002
NWPAN   0080  0086
PANUP   0245  0246
ROFUS   0005  0278  0283  0289  0289  0293  0294
ROLLQ   0062  0065  0066
SLOPE   0225  0226
START   0021
INVOK   0091  0095  0096  0179  0183  0184  0238  0242  0243  0324  0330  0331  0366  0370  0371  0387  0391  0392
IZORD   0004  0083  0083  0110  0111  0112  0113
WSPAN   0075  0076  0077
XFPCT   0005  0276  0283  0283  0286  0287  0302  0307  0308
XFUSN   0003  0276  0277  0283  0283  0302  0303
XFUS1   0003  0276  0277  0283  0283  0302  0303
XMACH   0002  0026  0051  0052
XREST   0002  0030  0033  0033
ZCP12   0007  0353  0358  0359
ZFUSS   0170  0175  0176  0177  0178
ZFWLE   0226  0227  0228  0231  0232
CANORD  0004
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
CANORG  0004  0385  0386
CANOR1  0004
CORDF1  0171  0175  0176  0233  0234  0235  0236  0237
CORDF2  0174  0177  0178
FINORD  0004
FINORG  0004  0364  0365
FLOATX  0044  0048  0049
FLOATY  0045  0048  0049
FUSARD  0004
FUSRAD  0004  0202  0278
FUSTYP  0009  0012  0014  0204
IPANUP  0246  0247  0248  0250  0252  0252  0252
IQUANT  0101  0104  0105  0191  0194  0195  0263  0266  0267  0342  0345  0346  0376  0379  0380  0397  0399  0400
ITRMAX  0047  0C48  0049
J2TEST  0002  0117  0189  0206  0261
LATRAL  0059  0065  0066
LSTDT8  0011
NALPHA  0053  0057  0057  0058  0058
NCANOR  0002  0019
NFINOR  0002  0019
NPODOR  0002  0019  0319  0325  0341
NPTSPS  0004
NSWVOR  0013  0014
NTHETA  0002  0023
NWAFOR  0002  0019  0082  0100  0110  0111  0112  0113
PHIREF  0228  0244
PITCHQ  0061  0065  0066
PODORD  0004  0318  0334  0353  0353
PODORG  0004  0316  0317  0318
REXPAR  0042  0048  0049
RHOREF  0227  0231  0232  0255  0256  0283  0289
WAFORD  0004
WAFORG  0004  0075  0083  0087  0088  0089  0090  0138  0138  0158  0167  0170  0173  0211  0226  0227  0227  0228  0228
        0283  0283  0283  0303
XFUSS1  0168  0175  0176  0207  0229  0234  0235  0236  0237
XFUSS2  0172  0177  0178
YFUSMX  0005  0126  0130  0135  0135  0169  0202
YFUSS1  0169  0175  0176  0230  0234  0235  0236  0237
YFUSS2  0173  0177  0178
ZFUSS1  0231  0234  0235
ZFUSS2  0232  0236  0237
```

```
                                  *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

LABEL   DEFINED    REFERENCES
  10    0016       0017  0037
  20    0018       0038
  30    0020       0019
  40    0025       0023
  50    0031       0030
  60    0034       0032
  70    0036       0028
  80    0084       0082
  90    0065       0081
 100    0114       0086
 110    0115       0078  0106
 120    0118       0117
 130    0131       0118  0121  0122  0128
 140    0132       0206  0206  0306
 150    0136       0134
 160    0137       0132
 170    0145       0141
 180    0146       0139
 190    0147       0143
 200    0157       0151  0155
 210    0165       0163
 220    0166       0161
 230    0199       0117  0117
 240    0203       0199  0201
 250    0207       0204
 260    0214       0208  0210
 270    0215       0212
 290    0254       0249
 300    0280       0275
 310    0281       0271
 320    0285       0282
 330    0290       0288
 340    0296       0206
 350    0305       0297  0301
 360    0307       0196
 370    0312       0309
 380    0313       0115  0198  0268  0295
 390    0323       0320
 400    0335       0332
 410    0349       0347
 420    0354       0352
 440    0360       0315
 450    0361       0313
 460    0381       0363
 470    0382       0361
 480    0401       0384
 490    0402       0382
 500    0407       0048
 510    0408       0049
 520    0409       0051  0057  0065
 530    0410       0052  0058  0066
 540    0411       0076
```

```
                                   *****FORTRAN CROSS REFERENCE LISTING*****

LABEL   DEFINED   REFERENCES
 550     0412     0077
 560     0413     0087  0089
 570     0414     0088  0090
 580     0415     0095  0183  0242  0330  0370  0591
 590     0416     0096  0184  0243  0331  0371  0392
 600     0417     0104  0194  0266  0345  0379  0399
 610     0418     0105  0195  0267  0346  0380  0400
 620     0419     0108  0255  0286  0291  0293  0307  0310  0336  0350  0356  0357  0358
 630     0420     0109  0256  0287  0292  0294  0308  0311  0337  0351  0359
 640     0421     0110  0112
 650     0422     0111  0113
 660     0423     0364
 670     0424     0365
 680     0425     0385
 690     0426     0386
 700     0427     0405
 710     0428     0406
 720     0429     0175  0177  0234  0236
 730     0430     0176  0178  0235  0237
 740     0431     0321
 750     0432     0322
 760     0433     0015
```

```
                                    /    MAIN /    SIZE OF PROGRAM 003B78 HEXADECIMAL BYTES PAGE 019

  NAME    TAG      TYPE  ADD.        NAME    TAG      TYPE  ADD.        NAME    TAG      TYPE  ADD.        NAME    TAG      TYPE  ADD.
     I SF        I*4  00039C           J  F        I*4  0003A0           V       C   R*4    N.R.          A1 SF        R*4  0003A4
    A2 SF        R*4  0003A8          IC SFA       I*4  0003AC          II SF        I*4  0003B0          IT SF        I*4  0003B4
    JJ SF        I*4  0003B8          JK SF        I*4  0003BC          J0 S     C   I*4  000050          J1 S     C   I*4  000054
    J2 S     C   I*4  000058          J3 S     C   I*4  00005C          J4 S     C   I*4  000060          J5 S     C   I*4  000064
    J6 S     C   I*4  000068          KI SF        I*4  0003C0          KK SF        I*4  0003C4          LL SF        I*4  0003C8
    LN SFA       I*4  0003CC          L3  F        I*4  0003D0          NF SF    C   I*4  0000A0          NN SF        I*4  0003D4
    NP SF    C   I*4  000098          NX S     C   I*4  0000C8          X1 SF        R*4  0003D8          Y1 SF        R*4  0003DC
    Z1 SF        R*4  0003E0         ABC SF    C   R*4  000000         DTR SF        R*4  0003E4         DX1 SF        R*4  0003E8
   DX2 SF        R*4  0003EC         HAG SF        R*4  0003F0         ITS SF        I*4  0003F4         KEY SFA       I*4  0003F8
   LAX SF        I*4  0003FC         LAY SF        I*4  000400         NAP SF        I*4  000404         NPP SF        I*4  000408
   NXS SF        I*4  00040C         NYS SF        I*4  000410         NZS SF        I*4  000414         PHI SF        R*4  000538
   PSI SF        R*4  000418         RHO SF        R*4  00041C         SKL  F    C   R*4  0000FC         SPC SF        R*4  000420
   XAF SF    C   R*4  000000        ABCD           R*4    N.R.        AFUS SF        R*4  000560        CBAR SF        R*4  000424
  CURV SF        R*4  000428        JITS S         I*4  00042C        KISS SF        I*4  000430        KUSS SF        I*4  000434
  LERR S     C   I*4  000084        MACH SFA       I*4  000438        NCAN SF    C   I*4  0000A8        NCON S         I*4  00043C
  NFUS SF    C   I*4  000074        NPAN SF        I*4  000440        NPLT S         I*4  000444        NWAF SF    C   I*4  00006C
  PDES       C   R*4    N.R.        REFA  F    C   R*4  0000BC        RNCV SF        R*4  000448        SFUS  FA   C   R*4  002AF8
  SREF SF        R*4  00044C        TEMP SFA       R*4  000450        VINF SF        R*4  000454        XAFT SF        R*4  000458
  XBAR SF        R*4  00045C        XCAN       C   R*4    N.R.        XDIV SF        R*4  000460        XFIN       C   R*4    N.R.
  XFUS  F    C   R*4  002738        XFWD SF        R*4  000464        XMID SF        R*4  000468        XONE SF        R*4  00046C
  XPOD  F    C   R*4  004374        YAWQ SF        R*4  000470        ZAFT SF        R*4  000474        ZBAR SF        R*4  000478
  ZC12 SF        R*4  000730        ZERO SF        R*4  00047C        ZFUS  F    C   R*4  002918        ZFWD SF        R*4  000480
 AINC1 SF        R*4  000484       AINC2 SF        R*4  000488       ALPHA SF        R*4  0007F8       CORD1 SF        R*4  00048C
 DPHEU SF        R*4  000490       DPHLO SF        R*4  000494       DUPER SF        R*4  000498       DXMID S         R*4  00049C
 DXWLE S         R*4  0004A0       IBCON SF        I*4  0004A4       INPUT  F             501003       ISOLV SF        I*4  0004A8
 ISYNT SF        I*4  0004AC       KIMID SF        I*4  0004B0       LNMID SF        I*4  0004B4       NCASE S     C   I*4  0000C0
 NFORX SF    C   I*4  000088       NFUSP SF        I*4  0004B8       NKODE S         I*4  0004BC       NMACH SF        I*4  0004C0
 NRADX SF    C   I*4  000078       NREST S     C   I*4  0000D0       NRICH       C   I*4    N.R.       NWPAN SF        I*4  0004C4
 PANUP SF        R*4  0004C8       ROFUS SF        R*4  000814       ROLLQ SF        R*4  0004CC       SLOPE SF        R*4  0004D0
 START SF    XF  R*4  000000       TNVOR SF        R*4  0004D4       TZORD SF    C   R*4  001DD8       WSPAN SF        R*4  0004D8
 XFPCT SF        R*4  0008DC       XFUSN  F    C   R*4  000008       XFUS1  F    C   R*4  000004       XMACH SF    C   R*4  0000C4
 XREST SF    C   R*4  0000D4       ZCP12 SF        R*4  0009A4       ZFUSS SF        R*4  0004DC       ZFWLE SFA       R*4  0004E0
  ATAN       XF  R*4  000000        SQRT       XF  R*4  000000      CANORD       C   R*4    N.R.      CANORG  F    C   R*4  000C28
CANOR1       C   R*4    N.R.      CORCF1 SF        R*4  0004E4      CORDF2 SF        R*4  0004E8      FINORD       C   R*4    N.R.
FINORG  F    C   R*4  000898      FLOATX SF        R*4  0004EC      FLOATY SF        R*4  0004F0      FRONL#  F    XF  I*4  000000
FUSARD       C   R*4    N.R.      FUSRAD  F    C   R*4  003AE8      FUSTYP S         I*4  0004F4      IBCOM#  F    XF  I*4  000000
IPANUP SF        I*4  0004F8      IQUANT SF        I*4  0004FC      ITRMAX SF        I*4  000500      J2TEST  F    C   I*4  0000B0
LATRAL SF        I*4  000504      LSTDT3 SF    XF  I*4  000000      NALPHA SF        I*4  000508      NCANOR S     C   I*4  0000AC
NFINOR S     C   I*4  0000A4      NPODOR SF    C   I*4  00009C      NPTSPS       C   I*4    N.R.      NSWVOR S         I*4  00050C
NTHETA S     C   I*4  0000CC      NWAFOR SF    C   I*4  000070      PHIREF SF        R*4  000510      PITCHQ SF        R*4  000514
PODORD  F    C   R*4  0047AC      PODORG  F    C   R*4  004308      REXPAR SF        R*4  000518      RHOREF SF        R*4  00051C
WAFORD       C   R*4    N.R.      WAFORG  FA   C   R*4  000078      XFUSS1 SF        R*4  000520      XFUSS2 SF        R*4  000524
YFUSMX SF        R*4  0000DC      YFUSS1 SF        R*4  000528      YFUSS2 SF        R*4  00052C      ZFUSS1 SF        R*4  000530
ZFUSS2 SF        R*4  000534

                              *****   COMMON INFORMATION   *****

    NAME OF COMMON BLOCK  *       *   SIZE OF BLOCK    000100 HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
```

```
      ABC    R*4   000000           J0    I*4   000050           J1    I*4   000054           J2    I*4   000058
       J3    I*4   00005C           J4    I*4   000060           J5    I*4   000064           J6    I*4   000068
     NWAF    I*4   00006C       NWAFOR    I*4   000070         NFUS    I*4   000074        NRADX    I*4   000078
    NFORX    I*4   000088           NP    I*4   000098       NPODOR    I*4   00009C           NF    I*4   0000A0
   NFINOR    I*4   0000A4         NCAN    I*4   0000A8       NCANOR    I*4   0000AC       J2TEST    I*4   0000B0
     LERR    I*4   0000B4        NRICH    I*4     N.R.         REFA    R*4   0000BC        NCASE    I*4   0000C0
    XMACH    R*4   0000C4           NX    I*4   0000C8       NTHETA    I*4   0000CC        NREST    I*4   0000D0
    XREST    R*4   0000D4          SKL    R*4   0000FC

  NAME OF COMMON BLOCK  * BLK2*   SIZE OF BLOCK    00000C HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
        V   R*4     N.R.          XFUS1   R*4   000004          XFUSN   R*4   000008

  NAME OF COMMON BLOCK  * BLACK*  SIZE OF BLOCK    00DDF8 HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
      XAF   R*4   000000         WAFORG   R*4   000078         WAFORD   R*4     N.R.          TZORD   R*4   001DD8
     XFUS   R*4   002738           ZFUS   R*4   002918           SFUS   R*4   002AF8         FUSARD   R*4     N.R.
   FUSRAD   R*4   003AE8         PODORG   R*4   004308           XPOD   R*4   004374         PODORD   R*4   0047AC
   NPTSPS   I*4     N.R.           PDES   R*4     N.R.         FINORG   R*4   00D898           XFIN   R*4     N.R.
   FINORD   R*4     N.R.         CANORG   R*4   00DC28           XCAN   R*4     N.R.         CANORD   R*4     N.R.
   CANORI   R*4     N.R.
```

```
LABEL    ADDR            LABEL    ADDR            LABEL    ADDR            LABEL    ADDR

   60   00128C              70   0012A8              80   0016FE              90   001716
  100   0018CA             110   001BDE             120   001C08             130   001CF0
  140   001D30             150   001DD0             160   001DE4             170   001E5A
  180   001E6E             190   001E86             200   001F14             210   001F86
  220   001FCA             230   0022E2             240   002336             250   00238A
  260   0023E4             270   002410             290   0028D8             300   002B70
  310   002B84             320   002C0A             330   002CCA             340   002DE4
  350   002EBA             360   002EEA             370   002FF4             380   003008
  390   00310C             400   003242             410   00341C             420   003500
  440   0035EA             450   003602             460   003854             470   00386C
  480   003ABC             490   003AD4             760   00383C
```

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LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*      NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,

*OPTIONS IN EFFECT*      SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF

*STATISTICS*     SOURCE STATEMENTS =      433  ,PROGRAM SIZE =     15224

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******
```

```
LEVEL 21.8 ( JUN 74 )                         OS/360  FORTRAN H                                           DATE  77.061/21.08.32
```

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LOCKHEED PROPRIETARY DATA

```
         COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                           SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
ISN 0002                SUBROUTINE START                                                 00006150
               C                                                                         00006160
               C    INPUTS AND INITIALITES CONFIGURATION DESCRIPTION                     00006170
               C    REFERENCE NASA TM X-2074, SEPT 1970                                  00006180
               C                                                                         00006190
ISN 0003                COMMON ABC (20), J0, J1, J2, J3, J4, J5, J6, NWAF, NWAFOR, NFUS, 00006200
                       *  NRADX (4), NFORX (4), NP, NPODOR, NF, NFINOR, NCAN, NCANOR,     00006210
                       * J2TEST, LERR, NRICH, REFA, NCASE, XMACH, NX, NTHETA, NREST,      00006220
                       * XREST (10), SKL                                                  00006230
ISN 0004                  COMMON/BLK2/V,XFUS1,XFUSN                                      00006240
ISN 0005                COMMON/BLACK/XAF (30), WAFORG (20, 4), WAFORD (20, 3, 30),       00006250
                       * TZORD (20, 30), XFUS (30, 4), ZFUS (30, 4), SFUS (30, 30, 1),    00006260
                       * FUSARD (30, 4), FUSRAD (130, 4), PODORG (9, 3), XPOD (9, 30),    00006270
                       * PODORD (9, 30), NPTSPS (5), PDES (20, 30, 10), FINORG (6, 2, 4), 00006280
                       * XFIN (6, 10), FINORD (6, 2, 10), CANORG (2, 2, 4), XCAN (2, 10), 00006290
                       * CANORD (2, 2, 10), CANOR1 (2, 2, 10)                             00006300
               C                                                                         00006310
ISN 0006                DIMENSION ABCD (20), FDRAG (4), PARNO (5), PARBA (5)             00006320
               C                                                                         00006330
ISN 0007                DATA PI/3.14159265/                                              00006340
               C                                                                         00006350
ISN 0008         10     FORMAT (10F7.0)                                                  00006360
               C                                                                         00006370
               C            REFERENCE AREA                                               00006380
               C                                                                         00006390
ISN 0009                IF (J0 .NE. 1) GO TO 140                                         00006400
ISN 0011                READ (5, 10) REFA, SKL                                           00006410
ISN 0012                IF (SKL .EQ. 0.) SKL = 1.                                        00006420
               C                                                                         00006430
               C            WING                                                         00006440
               C                                                                         00006450
ISN 0014                IF (J1 .NE. 2) GO TO 20                                          00006460
ISN 0016                GO TO 110                                                        00006470
ISN 0017         20     V = 0.                                                           00006480
ISN 0018                IF (J1 .EQ. 0) GO TO 140                                         00006490
ISN 0020                N = IABS (NWAFOR)                                                00006500
ISN 0021                NREC = (N + 9) /10                                               00006510
ISN 0022                I1 = -9                                                          00006520
ISN 0023                I2 = 0                                                           00006530
ISN 0024                DO 30 NN = 1, NREC                                               00006540
ISN 0025              I1 = I1 + 10                                                    00006550
ISN 0026              I2 = I2 + 10                                                    00006560
ISN 0027              READ (5, 10) (XAF (I), I = I1, I2)                              00006570
ISN 0028        30    CONTINUE                                                        00006580
ISN 0029              DO 40 I = 1, NWAF                                               00006590
ISN 0030              READ (5, 10) (WAFORG (I, J), J  = 1, 4)                         00006600
ISN 0031              DO 40 J = 1, 4                                                  00006610
ISN 0032              WAFORG (I, J) = WAFORG (I, J) /SKL                              00006620
ISN 0033        40    CONTINUE                                                        00006630
ISN 0034              IF  (J1  .LT. 0) GO TO 70                                       00006640
ISN 0036              DO 60 NN  = 1, NWAF                                             00006650
ISN 0037              I1 = -9                                                         00006660
ISN 0038              I2 = 0                                                          00006670
ISN 0039              DO 50 N1 = 1, NREC                                              00006680
ISN 0040              I1 = I1 + 10                                                    00006690
ISN 0041              I2 = I2 + 10                                                    00006700
ISN 0042              READ (5, 10) (TZORD (NN, I), I = I1, I2)                        00006710
ISN 0043              DO 50 I = I1, I2                                                00006720
ISN 0044              TZORD (NN, I) = TZORD (NN, I) /SKL                              00006730
ISN 0045        50    CONTINUE                                                        00006740
ISN 0046        60    CONTINUE                                                        00006750
ISN 0047              GO TO 90                                                        00006760
ISN 0048        70    DO 80 I = 1, NWAF                                               00006770
ISN 0049              DO 80 K = 1, N                                                  00006780
ISN 0050        80    TZORD (I, K) = 0.                                               00006790
ISN 0051        90    L = 1                                                           00006800
ISN 0052              IF (NWAFOR .LT. 0) L = 2                                        00006810
ISN 0054              DO 110 NN = 1, NWAF                                             00006820
ISN 0055              DO 110 K = 1, L                                                 00006830
ISN 0056              I1 = -9                                                         00006840
ISN 0057              I2 = 0                                                          00006850
ISN 0058              DO 100 N1 = 1, NREC                                             00006860
ISN 0059              I1 = I1 + 10                                                    00006870
ISN 0060              I2 = I2 + 10                                                    00006880
ISN 0061              READ (5, 10) (WAFORD (NN, K, I), I = I1, I2)                    00006890
ISN 0062       100    CONTINUE                                                        00006900
ISN 0063       110    CONTINUE                                                        00006910
ISN 0064              IF (NWAFOR .LT. 0) GO TO 130                                    00006920
ISN 0066              DO 120 NN = 1, NWAF                                             00006930
ISN 0067              DO 120 K = 1, N                                                 00006940
ISN 0068       120    WAFORD (NN, 2, K) = WAFORD (NN, 1, K)                           00006950
ISN 0069       130    CONTINUE                                                        00006960
ISN 0070              NWAFOR = IABS (NWAFOR)                                          00006970
ISN 0071              J1 = IABS (J1)                                                  00006980
               C                                                                      00006990
               C          FUSELAGE                                                    00007000
               C                                                                      00007010
ISN 0072       140    IF (J2 .NE. 2) GO TO 150                                        00007020
ISN 0074              GO TO 310                                                       00007030
ISN 0075       150    IF (J2 .EQ. 0) GO TO 310                                        00007040
ISN 0077              J2TEST = 3                                                      00007050
ISN 0078              IF (J2 .EQ. -1 .AND. J6 .EQ. -1) J2TEST = 1                     00007060
ISN 0080              IF (J2 .EQ. -1 .AND. J6 .EQ. 0) J2TEST = 2                      00007070
ISN 0082            IF (J6 .EQ. 1) J2TEST = 1                                   00007080
ISN 0084            J2 = 1                                                      00007090
ISN 0085            NSUM = 1                                                    00007100
ISN 0086            DO 160 NFU = 1, NFUS                                        00007110
ISN 0087      160   NSUM = NSUM + NFORX (NFU) -1                                00007120
ISN 0088            IF  (NSUM  .LE. 101) GO TO 180                              00007130
ISN 0090            WRITE  (6, 170)                                             00007140
ISN 0091      170   FORMAT  (//                                                 00007150
                   * 60H CONSECUTIVE FUSELAGE POINTS EXCEED ALLOWABLE STORAGE OF 101 /00007160
                   * 1H1)                                                       00007170
ISN 0092            STOP                                                        00007180
ISN 0093      180   CONTINUE                                                    00007190
ISN 0094            DO 270 NFU = 1, NFUS                                        00007200
ISN 0095            N = NFORX (NFU)                                             00007210
ISN 0096            NRAD = NRADX (NFU)                                          00007220
ISN 0097            NREC = (N + 9) /10                                          00007230
ISN 0098            I1 = -9                                                     00007240
ISN 0099            I2 = 0                                                      00007250
ISN 0100            DO 190 N1 = 1, NREC                                         00007260
ISN 0101            I1 = I1 + 10                                                00007270
ISN 0102            I2 = I2 + 10                                                00007280
ISN 0103            READ (5, 10) (XFUS (I, NFU), I = I1, I2)                    00007290
ISN 0104            DO 190 I = I1, I2                                           00007300
ISN 0105            XFUS (I, NFU) = XFUS (I, NFU) /SKL                          00007310
ISN 0106      190   CONTINUE                                                    00007320
ISN 0107            IF (NFU .NE. 1) GO TO 200                                   00007330
ISN 0109            XFUS1 = XFUS (1, 1)                                         00007340
ISN 0110            XFUSN = XFUS (N, 1)                                         00007350
ISN 0111      200   XFUS1 = AMIN1 (XFUS1, XFUS  (1, NFU))                       00007360
ISN 0112            XFUSN = AMAX1 (XFUSN, XFUS (N, NFU))                        00007370
ISN 0113            IF (J2TEST  .NE. 2) GO TO 220                               00007380
ISN 0115            I1 = -9                                                     00007390
ISN 0116            I2 = 0                                                      00007400
ISN 0117            DO 210 N1 = 1, NREC                                         00007410
ISN 0118            I1 = I1 + 10                                                00007420
ISN 0119            I2 = I2 + 10                                                00007430
ISN 0120            READ (5, 10) (ZFUS (I, NFU), I = I1, I2)                    00007440
ISN 0121            DO 210 I = I1, I2                                           00007450
ISN 0122            ZFUS (I, NFU) = ZFUS (I, NFU) /SKL                          00007460
ISN 0123      210   CONTINUE                                                    00007470
ISN 0124            GO TO 240                                                   00007480
ISN 0125      220   DO 230 I = 1, N                                             00007490
ISN 0126      230   ZFUS (I, NFU) = 0.                                          00007500
ISN 0127      240   IF (J2TEST  .NE. 3) GO TO 280                               00007510
ISN 0129            NCARD = (NRAD + 9) /10                                      00007520
ISN 0130            DO 270 LN = 1, N                                            00007530
ISN 0131            DO 260 K = 1, 2                                             00007540
ISN 0132            KK = K + (NFU - 1) *2                                       00007550
ISN 0133            II = 10                                                     00007560
ISN 0134            I1 = -9                                                     00007570
ISN 0135            I2 = 0                                                      00007580
ISN 0136            DO 250 NN = 1, NCARD                                        00007590
ISN 0137            IF (NN .EQ. NCARD) II = MOD (NRAD, 10)                      00007600
ISN 0139          IF (II .EQ. 0) II = 10                                            00007610
ISN 0141          I1 = I1 + 10                                                      00007620
ISN 0142          I2 = I2 + II                                                      00007630
ISN 0143          READ (5, 10) (SFUS (I, LN, KK), I = I1, I2)                       00007640
ISN 0144          DO 250 I = I1, I2                                                 00007650
ISN 0145          SFUS (I, LN, KK) = SFUS (I, LN, KK) /SKL                          00007660
ISN 0146      250 CONTINUE                                                          00007670
ISN 0147      260 CONTINUE                                                          00007680
ISN 0148      270 CONTINUE                                                          00007690
ISN 0149          GO TO 310                                                         00007700
ISN 0150      280 I1 = -9                                                           00007710
ISN 0151          I2 = 0                                                            00007720
ISN 0152          DO 290 N1 = 1, NREC                                               00007730
ISN 0153          I1 = I1 + 10                                                      00007740
ISN 0154          I2 = I2 + 10                                                      00007750
ISN 0155          READ (5, 10) (FUSARD (I, NFU), I = I1, I2)                        00007760
ISN 0156          DO 290 I = I1, I2                                                 00007770
ISN 0157          FUSARD (I, NFU) = FUSARD (I, NFU) /SKL**2                         00007780
ISN 0158      290 CONTINUE                                                          00007790
ISN 0159          DO 300 I = 1, N                                                   00007800
ISN 0160      300 FUSRAD (I, NFU) = SQRT (FUSARD (I, NFU) /PI)                      00007810
             C                                                                      00007820
             C        NACELLES                                                      00007830
             C                                                                      00007840
ISN 0161      310 IF (J3 .NE. 2) GO TO 320                                          00007850
ISN 0163          GO TO 440                                                         00007860
ISN 0164      320 IF (J3 .EQ. 0) GO TO 440                                          00007870
ISN 0166          N = NPODOR                                                        00007880
ISN 0167          NREC = (N + 9) /10                                                00007890
ISN 0168          DO 410 NN = 1, NP                                                 00007900
ISN 0169          READ (5, 10) (PODORG (NN, I), I = 1, 3)                           00007910
ISN 0170          DO 330 I = 1, 3                                                   00007920
ISN 0171      330 PODORG (NN, I)  = PODORG (NN, I) /SKL                             00007930
ISN 0172          I1 = -9                                                           00007940
ISN 0173          I2 = 0                                                            00007950
ISN 0174          DO 340 N1 = 1, NREC                                               00007960
ISN 0175          I1 = I1 + 10                                                      00007970
ISN 0176          I2 = I2 + 10                                                      00007980
ISN 0177          READ (5, 10) (XPOD (NN, I), I = I1, I2)                           00007990
ISN 0178          DO 340 I = I1, I2                                                 00008000
ISN 0179          XPOD (NN, I) = XPOD (NN, I) /SKL                                  00008010
ISN 0180      340 CONTINUE                                                          00008020
ISN 0181          IF (J3 .NE. -1) GO TO 390                                         00008030
             C                                                                      00008040
             C ARBITRARILY DEFINED POD --READ NO. PTS FOR EACH STATION/POD           00008050
             C                                                                      00008060
ISN 0183          READ (5, 10 ) AN                                                  00008070
ISN 0184          NPTSPS (NN) = AN                                                  00008080
ISN 0185          NPTS = NPTSPS (NN)                                                00008090
ISN 0186          NCARD = (NPTSPS (NN) + 9) /10                                     00008100
             C                                                                      00008110
             C   NCARD = NO. CARDS  AT EACH STATION(I ) FOR EACH POD(NN)            00008120
             C                                                                      00008130
```

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ISN 0187          DO 380 LN = 1, NPODOR                                     00008140
            C                                                               00008150
            C            LN  STATION LOOP                                   00008160
            C                                                               00008170
ISN 0188          DO 370 K = 1, 2                                           00008180
ISN 0189          KK = K + (NN - 1) *2                                      00008190
ISN 0190          EV = 2 *K - 3                                             00008200
ISN 0191          II = 10                                                   00008210
ISN 0192          I1 = -9                                                   00008220
ISN 0193          I2 = 0                                                    00008230
ISN 0194          DO 360 NA = 1, NCARD                                      00008240
ISN 0195          IF (NA .EQ. NCARD) II = MOD (NPTSPS (NN), 10)             00008250
ISN 0197          IF  (II  .EQ. 0) II = 10                                  00008260
ISN 0199          I1 = I1 + 10                                              00008270
ISN 0200          I2 = I2 + II                                              00008280
ISN 0201          READ (5, 10) (PDES (I, LN, K + (NN - 1) *2), I = I1, I2)  00008290
ISN 0202          DO 350 I = I1, I2                                         00008300
ISN 0203          IF (PODORG (NN, 2)  .EQ. 0.) GO TO 350                    00008310
ISN 0205          IF (I .EQ. NPTS) GO TO 350                                00008320
ISN 0207          PDES ( (NPTS - I) *2 + I, LN, KK)  = EY*PDES (I, LN, KK) /SKL +  00008330
                * PODORG (NN, K + 1)                                        00008340
ISN 0208     350  PDES (I, LN, K + (NN - 1) *2) = PDES (I, LN, K + (NN - 1) *2)    00008350
                * /SKL + PODORG (NN, K + 1)                                 00008360
ISN 0209     360  CONTINUE                                                  00008370
ISN 0210     370  CONTINUE                                                  00008380
ISN 0211     380  CONTINUE                                                  00008390
ISN 0212          LPF = 1                                                   00008400
ISN 0213          IF (PODORG (NN, 2) .NE. 0.) NPTSPS (NN) = NPTSPS (NN) *2 - 1     00008410
ISN 0215          GO TO 410                                                 00008420
ISN 0216     390  LPF = 0                                                   00008430
ISN 0217          I1 = -9                                                   00008440
ISN 0218          I2 = 0                                                    00008450
ISN 0219          DO 400 N1 = 1, NREC                                       00008460
ISN 0220          I1 = I1 + 10                                              00008470
ISN 0221          I2 = I2 + 10                                              00008480
ISN 0222          READ (5, 10) (PODORD (NN, I), I = I1, I2)                 00008490
ISN 0223          DO 400 I = I1, I2                                         00008500
ISN 0224          PODORD (NN, I) = PODORD (NN, I) /SKL                      00008510
ISN 0225     400  CONTINUE                                                  00008520
ISN 0226     410  CONTINUE                                                  00008530
ISN 0227          IF (LPF .EQ. 0) GO TO 440                                 00008540
ISN 0229          DO 430 NN = 1, NP                                         00008550
            C                                                               00008560
            C COMPUTE   POD   AREAS                                         00008570
            C                                                               00008580
ISN 0230          KK = 1 + (NN - 1) *2                                      00008590
ISN 0231          DO 420 I = 1, NPODOR                                      00008600
ISN 0232          PSI = 0.                                                  00008610
ISN 0233          NPTS = NPTSPS (NN)                                        00008620
ISN 0234          DO 420 K = 2, NPTS                                        00008630
ISN 0235          ABAR = PDES (K - 1, I, KK) *PDES (K, I, KK + 1) - PDES (K, I, KK) 00008640
                * *PDES (K - 1, I, KK + 1)                                  00008650
ISN 0236          PSI = PSI + ABAR                                          00008660
ISN 0237          IF (I .EQ. 1) PARNO (NN) = PSI                                             00008670
ISN 0239      420 CONTINUE                                                                   00008680
ISN 0240      430 PARBA (NN) = PSI                                                           00008690
              C                                                                              00008700
              C          FINS                                                                00008710
              C                                                                              00008720
ISN 0241      440 IF (J4 .NE. 2) GO TO 450                                                   00008730
ISN 0243          GO TO 480                                                                  00008740
ISN 0244      450 IF (J4 .EQ. 0) GO TO 480                                                   00008750
ISN 0246          N = NFINOR                                                                 00008760
ISN 0247          DO 470 NN  = 1, NF                                                         00008770
ISN 0248          READ (5, 10) ((FINORG (NN, I, J), J = 1, 4), I = 1, 2)                     00008780
ISN 0249          DO 460 I = 1, 2                                                            00008790
ISN 0250          DO 460 J = 1, 4                                                            00008800
ISN 0251      460 FINORG (NN, I, J) = FINORG (NN, I, J) /SKL                                 00008810
ISN 0252          READ (5, 10) (XFIN (NN, I), I = 1, N)                                      00008820
ISN 0253          READ (5, 10) (FINORD (NN, 1, J) , J = 1, N)                                00008830
ISN 0254      470 CONTINUE                                                                   00008840
              C                                                                              00008850
              C          CANARDS                                                             00008860
              C                                                                              00008870
ISN 0255      480 IF (J5 .NE. 2) GO TO 490                                                   00008880
ISN 0257          GO TO 540                                                                  00008890
ISN 0258      490 IF (J5 .EQ. 0) GO TO 540                                                   00008900
ISN 0260          N = IABS (NCANOR)                                                          00008910
ISN 0261          DO 530 NN  = 1, NCAN                                                       00008920
ISN 0262          READ (5, 10) ((CANORG (NN, I, J), J = 1, 4), I = 1, 2)                     00008930
ISN 0263          DO 500 I = 1, 2                                                            00008940
ISN 0264          DO 500 J = 1, 4                                                            00008950
ISN 0265      500 CANORG (NN, I, J) = CANORG (NN, I, J) /SKL                                 00008960
ISN 0266          READ (5, 10) (XCAN (NN, I), I = 1, N)                                      00008970
ISN 0267          READ (5, 10) (CANORD (NN, 1, J), J = 1, N)                                 00008980
ISN 0268          IF (NCANOR .LT. 0) GO TO 520                                               00008990
ISN 0270          DO 510 J = 1, N                                                            00009000
ISN 0271          DO 510 I = 1, 2                                                            00009010
ISN 0272          CANOR1 (NN, I, J) = CANORD (NN, I, J)                                      00009020
ISN 0273      510 CONTINUE                                                                   00009030
ISN 0274          GO TO 530                                                                  00009040
ISN 0275      520 READ (5, 10) (CANOR1 (NN, 1, J), J = 1, N)                                 00009050
ISN 0276          READ (5, 10) (CANOR1 (NN, 2, J), J = 1, N)                                 00009060
ISN 0277      530 CONTINUE                                                                   00009070
ISN 0278          NCANOR = IABS (NCANOR)                                                     00009080
ISN 0279      540 RETURN                                                                     00009090
ISN 0280          END                                                                        00009100
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                                  *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****              PAGE 007

YMBOL   INTERNAL STATEMENT NUMBERS
        0027 0027 0027 0029 0030 0032 0032 0042 0042 0042 0043 0044 0044 0048 0050 0061 0061 0061 0103
        0103 0103 0104 0105 0105 0120 0120 0120 0121 0122 0122 0125 0126 0143 0143 0143 0144 0145 0145
        0155 0155 0155 0156 0157 0157 0159 0160 0166 0169 0169 0169 0170 0171 0171 0177 0177 0177 0178
        0179 0179 0201 0201 0201 0202 0205 0207 0207 0207 0208 0208 0222 0222 0222 0223 0224 0224 0231
        0235 0235 0235 0235 0237 0248 0248 0248 0249 0251 0251 0252 0252 0252 0262 0262 0263 0263 0265
        0265 0266 0266 0266 0271 0272 0272
        0030 0030 0030 0031 0032 0032 0248 0248 0248 0250 0251 0251 0253 0253 0253 0262 0262 0262 0264
        0265 0265 0267 0267 0267 0270 0272 0272 0275 0275 0275 0276 0276 0276
        0049 0050 0055 0061 0067 0068 0068 0131 0132 0188 0189 0190 0201 0207 0208 0208 0208 0234 0235
        0235 0235 0235
        0051 0052 0055
        0020 0021 0049 0067 0095 0097 0110 0112 0125 0130 0159 0166 0167 0246 0252 0253 0260 0266 0267
        0270 0275 0276
        0004 0017
        0183 0184
        0190 0207
        0133 0137 0139 0139 0142 0191 0195 0197 0197 0200
        0022 0025 0025 0027 0037 0040 0040 0042 0043 0056 0059 0059 0061 0098 0101 0101 0103 0104 0115
        0118 0118 0120 0121 0134 0141 0141 0143 0144 0150 0153 0153 0155 0156 0172 0175 0175 0177 0178
        0192 0199 0199 0201 0202 0217 0220 0220 0222 0223
        0023 0026 0026 0027 0038 0041 0041 0042 0043 0057 0060 0060 0061 0099 0102 0102 0103 0104 0116
        0119 0119 0120 0121 0135 0142 0142 0143 0144 0151 0154 0154 0155 0156 0173 0176 0176 0177 0178
        0193 0200 0200 0201 0202 0218 0221 0221 0222 0223
        0003 0009
        0003 0014 0018 0034 0071 0071
        0003 0072 0075 0078 0080 0084
        0003 0161 0164 0181
        0003 0241 0244
        0003 0255 0258
        0003 0078 0080 0082
        0132 0143 0145 0145 0189 0207 0207 0230 0235 0235 0235 0235
        0130 0143 0145 0145 0187 0201 0207 0207 0208 0208
        0194 0195
        0003 0247
        0024 0036 0042 0044 0044 0054 0061 0066 0068 0068 0136 0137 0168 0169 0171 0171 0177 0179 0179
        0184 0185 0186 0189 0195 0201 0203 0207 0208 0208 0208 0213 0213 0213 0222 0224 0224 0229 0230
        0233 0237 0240 0247 0248 0251 0251 0252 0253 0261 0262 0265 0265 0266 0267 0272 0272 0275 0276
        0003 0168 0229
        0003
        0039 0058 0100 0117 0152 0174 0219
        0007 0160
C       0003
F       0212 0216 0227
D       0137 0195
U       0086 0087 0094 0095 0096 0103 0105 0105 0107 0111 0112 0120 0122 0122 0126 0132 0155 0157 0157
        0160 0160
I       0232 0236 0236 0237 0240
L       0003 0011 0012 0012 0032 0044 0105 0122 0145 0157 0171 0179 0207 0208 0224 0251 0265
F       0005 0027
AR      0235 0236
CD      0006
BS      0020 0070 0071 0260 0278
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*****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
LERR    0003
NCAN    0003  0261
NFUS    0003  0086  0094
NPTS    0185  0205  0207  0233  0234
NRAD    0096  0129  0137
NREC    0021  0024  0039  0058  0097  0100  0117  0152  0167  0174  0219
NSUM    0085  0087  0087  0088
NWAF    0003  0029  0036  0048  0054  0066
PDES    0005  0201  0207  0207  0208  0208  0235  0235  0235  0235
REFA    0003  0011
SFUS    0005  0143  0145  0145
SQRT    0160
XCAN    0005  0266
XFIN    0005  0252
XFUS    0005  0103  0105  0105  0109  0110  0111  0112
XPOD    0005  0177  0179  0179
ZFUS    0005  0120  0122  0122  0126
AMAX1   0112
AMIN1   0111
FDRAG   0006
NCARD   0129  0136  0137  0186  0194  0195
NCASE   0003
NFORX   0003  0087  0095
NRADX   0003  0096
NREST   0003
NRICH   0003
PARBA   0006  0240
PARMD   0006  0237
START   0002
TZORD   0005  0042  0044  0044  0050
XFUSN   0004  0110  0112  0112
XFUS1   0004  0109  0111  0111
XMACH   0003
XREST   0003
CANORD  0005  0267  0272
CANORG  0005  0262  0265  0265
CANOR1  0005  0272  0275  0276
FINORD  0005  0253
FINORG  0005  0248  0251  0251
FUSARD  0005  0155  0157  0157  0160
FUSRAD  0005  0160
J2TEST  0003  0077  0078  0080  0082  0113  0127
NCANOR  0003  0263  0268  0278  0278
NFINOR  0003  0246
NPODOR  0003  0166  0187  0231
NPTSPS  0005  0184  0185  0186  0195  0213  0213  0233
NTHETA  0003
NWAFOR  0003  0020  0052  0064  0070  0070
PODORD  0005  0222  0224  0224
PODORG  0005  0169  0171  0171  0203  0207  0208  0213
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                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
WAFORD  0005  0061  0068  0068
WAFORG  0005  0030  0032  0032
```

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                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****                  PAGE 010

LABEL   DEFINED    REFERENCES
   10   0008       0011  0027  0030  0042  0061  0103  0120  0143  0155  0169  0177  0183  0201  0222  0248  0252  0253
                   0262  0266  0267  0275  0276
   20   0017       0014
   30   0028       0024
   40   0033       0029  0031
   50   0045       0039  0043
   60   0046       0036
   70   0048       0034
   80   0050       0048  0049
   90   0051       0047
  100   0062       0058
  110   0063       0016  0054  0055
  120   0068       0066  0067
  130   0069       0064
  140   0072       0009  0018
  150   0075       0072
  160   0087       0086
  170   0091       0090
  180   0093       0088
  190   0106       0100  0104
  200   0111       0107
  210   0123       0117  0121
  220   0125       0113
  230   0126       0125
  240   0127       0124
  250   0146       0136  0144
  260   0147       0131
  270   0148       0094  0130
  280   0150       0127
  290   0158       0152  0156
  300   0160       0159
  310   0161       0074  0075  0149
  320   0164       0161
  330   0171       0170
  340   0180       0174  0178
  350   0208       0202  0203  0205
  360   0209       0194
  370   0210       0188
  380   0211       0187
  390   0216       0181
  400   0225       0219  0223
  410   0226       0168  0215
  420   0239       0231  0234
  430   0240       0229
  440   0241       0163  0164  0227
  450   0244       0241
  460   0251       0249  0250
  470   0254       0247
  480   0255       0243  0244
  490   0258       0255
  500   0265       0263  0264
  510   0273       0270  0271
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

LABEL   DEFINED   REFERENCES
 520     0275     0268
 530     0277     0261  0274
 540     0279     0257  0258
```

```
                                        /   START /    SIZE OF PROGRAM 00183C HEXADECIMAL BYTES PAGE 012

 NAME    TAG   TYPE  ADD.        NAME    TAG   TYPE  ADD.        NAME    TAG   TYPE  ADD.        NAME    TAG   TYPE  ADD.
     I SFA      I*4  000124          J SF       I*4  000128          K SF       I*4  00012C          L SF       I*4  000130
     N SFA      I*4  000134          V S     C  R*4  000000         AN SF       R*4  000138         EY SF       R*4  00013C
    II SF       I*4  000140         I1 SF       I*4  000144         I2 SF       I*4  000148         J0       C  I*4  000050
    J1 SFA   C  I*4  000054         J2 S     C  I*4  000058         J3       C  I*4  00005C         J4       C  I*4  000060
    J5       C  I*4  000064         J6       C  I*4  000068         KK SF       I*4  00014C         LN SF       I*4  000150
    NA SF       I*4  000154         NF  F    C  I*4  0000A0         NN SFA      I*4  000158         NP  F    C  I*4  000098
    NX       C  I*4    N.R.         N1 SF       I*4  00015C         PI  FA      R*4  000160        ABC       C  R*4    N.R.
   LPF S        I*4  000164        NFU SFA      I*4  000168        PSI SF       R*4  00016C        SKL SF    C  R*4  0000FC
   XAF S     C  R*4  000000       ABAR SF       R*4  000170       ABCD          R*4    N.R.       LERR       C  I*4    N.R.
  NCAN  F    C  I*4  0000A8       NFUS  F    C  I*4  000074       NPTS SF       I*4  000174       NRAD SFA      I*4  000178
  NREC SF       I*4  00017C       NSUM SF       I*4  000180       NWAF  F    C  I*4  00006C       PDES SF    C  R*4  004BF8
  REFA S     C  R*4  0000BC       SFUS SF    C  R*4  002AF8       XCAN S     C  R*4  000C68       XFIN S     C  R*4  000958
  XFUS SFA   C  R*4  002738       XPOD SF    C  R*4  004374       ZFUS SF    C  R*4  002918      FDRAG          R*4    N.R.
 NCARD SF       I*4  000184      NCASE       C  I*4    N.R.      NFORX  F    C  I*4  000088      NRADX  F    C  I*4  000078
 NREST       C  I*4    N.R.      NRICH       C  I*4    N.R.      PARBA S        R*4  00018C      PARNO S        R*4  0001A0
 START          R*4  000188      TZORD SF    C  R*4  001D08      XFUSN SFA   C  R*4  000008      XFUS1 SFA   C  R*4  000004
 XMACH       C  R*4    N.R.      XREST       C  R*4    N.R.       SQRT      XF  R*4  000000     CANORD SF    C  R*4  000C88
CANORG SF    C  R*4  000C28     CANOR1 S     C  R*4  000D58     FINORD S     C  R*4  000A48     FINORG SF    C  R*4  000898
FUSARD SFA   C  R*4  003908     FUSRAD S     C  R*4  003AE8     IBCOM#  F   XF  I*4  000000     J2TEST S     C  I*4  000080
NCANOR SFA   C  I*4  0000AC     NFINOR  F    C  I*4  0000A4     NPODOR  F    C  I*4  00009C     NPTSPS SFA   C  I*4  004BE4
NTHETA       C  I*4    N.R.     NWAFOR SFA   C  I*4  000070     PODORD SF    C  R*4  0047AC     PODORG SF    C  R*4  004308
WAFORD SF    C  R*4  000188     WAFORG SF    C  R*4  000078

                               *****  COMMON INFORMATION   *****


   NAME OF COMMON BLOCK  *       *   SIZE OF BLOCK    000100 HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
       ABC  R*4      N.R.             J0  I*4    000050             J1  I*4    000054             J2  I*4    000058
        J3  I*4    00005C             J4  I*4    000060             J5  I*4    000064             J6  I*4    000068
      NWAF  I*4    00006C         NWAFOR  I*4    000070           NFUS  I*4    000074          NRADX  I*4    000078
     NFORX  I*4    000088             NP  I*4    000098         NPODOR  I*4    00009C             NF  I*4    0000A0
    NFINOR  I*4    0000A4           NCAN  I*4    0000A8         NCANOR  I*4    0000AC         J2TEST  I*4    0000B0
      LERR  I*4      N.R.          NRICH  I*4      N.R.           REFA  R*4    0000BC          NCASE  I*4      N.R.
     XMACH  R*4      N.R.             NX  I*4      N.R.         NTHETA  I*4      N.R.          NREST  I*4      N.R.
     XREST  R*4      N.R.            SKL  R*4    0000FC

   NAME OF COMMON BLOCK  *  BLK2*   SIZE OF BLOCK    00000C HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
         V  R*4    000000          XFUS1  R*4    000004          XFUSN  R*4    000008

   NAME OF COMMON BLOCK  * BLACK*   SIZE OF BLOCK    000DF8 HEXADECIMAL BYTES

 VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.   VAR. NAME  TYPE  REL. ADDR.
       XAF  R*4    000000         WAFORG  R*4    000078         WAFORD  R*4    000188          TZORD  R*4    001D08
      XFUS  R*4    002738           ZFUS  R*4    002918           SFUS  R*4    002AF8         FUSARD  R*4    003908
    FUSRAD  R*4    003AE8         PODORG  R*4    004308           XPOD  R*4    004374         PODORD  R*4    0047AC
```

```
NPTSPS     I*4    0048E4          PDES     R*4    0048F8       FINORG    R*4    00D898          XFIN    R*4    00D958
FINORD     R*4    00DA48        CANORG     R*4    00DC28         XCAN    R*4    00DC68        CANORD    R*4    00DCB8
CANOR1     R*4    00DD58
```

```
  LABEL    ADDR               LABEL    ADDR               LABEL    ADDR               LABEL    ADDR           PAGE 014

     20  00024A                  30  0002EE                  40  000384                  50  00046C
     60  000490                  70  0004A6                  80  0004AE                  90  0004F0
    100  000592                 110  0005A4                 120  0005DA                 130  00062E
    140  000642                 150  000652                 160  0006B0                 180  000706
    190  0007F4                 200  000848                 210  00095C                 220  000984
    230  000988                 240  0009B8                 250  000AFE                 260  000B22
    270  000B34                 280  000B5C                 290  000C18                 300  000C40
    310  000CA4                 320  000CB4                 330  000D28                 340  000E24
    350  001080                 360  001104                 370  001116                 380  001128
    390  00117A                 400  001238                 410  00125C                 420  001366
    430  00138A                 440  0013AC                 450  0013BC                 460  001444
    470  001540                 480  001552                 490  001562                 500  0015EC
    510  00173E                 520  001766                 530  0017F8                 540  001814
```

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LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*      NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,

*OPTIONS IN EFFECT*      SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF

*STATISTICS*     SOURCE STATEMENTS =     279 ,PROGRAM SIZE =     6204

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                      25K BYTES OF CORE NOT USED
```

```
LEVEL 21.8 ( JUN 74 )                    OS/360  FORTRAN H                         DATE  77.061/21.08.39
```

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LOCKHEED PROPRIETARY DATA

```
      COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                          SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
ISN 0002               SUBROUTINE LSTDT8                                           00009110
             C                                                                     00009120
ISN 0003               DIMENSION A (20)                                            00009130
ISN 0004               WRITE (6, 40)                                               00009140
ISN 0005            10 I = 0                                                       00009150
ISN 0006            20 READ (5, 50,END=30) A                                       00009160
ISN 0007               WRITE (6, 80) A                                             00009180
ISN 0008               I = I + 1                                                   00009190
ISN 0009               IF (I .NE. 44) GO TO 20                                     00009200
ISN 0011               WRITE (6, 60)                                               00009210
ISN 0012               GO TO 10                                                    00009220
ISN 0013            30 REWIND 5                                                    00009230
ISN 0014               WRITE (6, 70)                                               00009240
ISN 0015               RETURN                                                      00009250
ISN 0016            40 FORMAT (1H1, 26HINPUT DATA LISTING FOLLOWS /1H )            00009260
ISN 0017            50 FORMAT (20A4)                                               00009270
ISN 0018            60 FORMAT (1H1)                                                00009280
ISN 0019            70 FORMAT (1H0, 17HINPUT DATA LISTED)                          00009290
ISN 0020            80 FORMAT (1H , 20A4)                                          00009300
ISN 0021               END                                                         00009310
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
A       0003  0006  0007
I       0005  0008  0008  0009
LSTDT8  0002
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
LABEL   DEFINED   REFERENCES
  10    0005      0012
  20    0006      0009
  30    0013      0006
  40    0016      0004
  50    0017      0006
  60    0018      0011
  70    0019      0014
  80    0020      0007
```

```
                                        /  LSTDT8 /     SIZE OF PROGRAM 00021C HEXADECIMAL BVTES PAGE 004

NAME    TAG   TYPE  ADD.          NAME    TAG   TYPE  ADD.          NAME   TAG   TYPE  ADD.          NAME    TAG   TYPE  ADD.
   A SF       R*4  0000E4            I SF       I*4  0000DC        IBCOM#  F  XF  I*4  000000        LSTDT8          I*4  0000E0
```

```
    LABEL    ADDR                LABEL    ADDR               LABEL    ADDR               LABEL    ADDR          PAGE 005

       10   000168                  20   00016C                 30   0001D8
```

LOCKHEED PROPRIETARY DATA

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LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*      NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,

*OPTIONS IN EFFECT*      SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF

*STATISTICS*     SOURCE STATEMENTS =      20 ,PROGRAM SIZE =      540

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                  93K BYTES OF CORE NOT USED

*STATISTICS*  NO  DIAGNOSTICS THIS STEP
```

```
F128-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED LIST,MAP
         DEFAULT OPTION(S) USED -  SIZE=(131072,18432)
IEW0000     INCLUDE COMPILE
IEW0000     ENTRY MAIN


                                                  MODULE MAP


  CONTROL SECTION                      ENTRY

    NAME     ORIGIN   LENGTH             NAME    LOCATION      NAME   LOCATION      NAME   LOCATION      NAME   LOCATION

  MAIN           00     3B78
  START        3B78     183C
  LSTDT8       53B8      21C
  IHCSATN2*    55D8      1CB
                                        ATAN2        55D8    ATAN         55EC
  IHCNAMEL*    57A8      AA7
                                        FRDNL#       57A8    FWRNL#       5D90
  IHCECOMH*    6250      F31
                                        IBCOM#       6250    FDIOCS#      630C    VFIOCS       7070    INTSW        716E
                                        INTSWTCH     716E
  IHCCOMH2*    7188      56D
                                        SEQDASD      7410
  IHCSSQRT*    76F8      145
                                        SQRT         76F8
  IHCFCVTH*    7840     1195
                                        ADCON#       7840    FCVAOUTP     78EA    FCVLOUTP     797A    FCVZOUTP     7ACA
                                        FCVIOUTP     7E70    FCVEOUTP     8372    FCVCOUTP     858C    INT6SWCH     8873
  IHCEFNTH*    89D8      512
                                        ARITH#       89D8    ADJSWTCH     8D44
  IHCEFIOS*    8EF0     1390
                                        FIOCS#       8EF0    FIOCSBEP     8EF6    MULFLS       90AC
  IHCERRM *    A280      5BC
                                        ERRMON       A280    IHCERRE      A298
  IHCUOPT *    A840      350
  IHCETRCH*    AB90      28E
                                        IHCTRCH      AB90    ERRTRA       AB98
  IHCUATBL*    AE20      648
 $BLANKCOM     B468      100
  BLK2         B568        C
  BLACK        B578     DDF8


 ENTRY ADDRESS       00
 TOTAL LENGTH     19370

****GOMODULE  DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET
```

```
INPUT DATA LISTING FOLLOWS

 &INPUT
 FUSTYP=1,
 &END
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
  1  1 -1  1  1  1  0  7 13  1 17 29                    2  3  2 10  1 10
 967680
0.        1.        5.        10.       20.       30.       40.       50.       60.       70.        XAF 10
80.       90.       100.                                                                            XAF 13
944.1     65.74     -54.96    1448.94                                                               WORG 02
1462.5    223.94    -54.47    925.97                                                                WORG 06
1768.8    317.41    -69.00    650.01                                                                WORG 08
1905.4    368.04    -77.16    529.87                                                                WORG 09
2225.8    486.83    -89.74    311.72                                                                WORG 11
2225.8    486.88    -89.74    311.72                                                                WORG 12
2479.3    645.05    -99.96    194.45                                                                WORG 13
0.        -.187     -1.98     -7.09     -18.24    -28.07    -35.89    -41.82    -46.3     -49.9      TZOR 02
-53.13    -56.52    -60.34                                                                          TZOR 02
0.        .49       2.5       2.85      1.06      -2.25     -6.32     -10.75    -15.32    -19.88     TZOR 06
-24.29    -28.42    -32.23                                                                          TZOR 06
0.        .09       1.11      2.27      2.69      2.13      1.        -.51      -2.31     -4.28      TZOR 08
-6.4      -8.6      -10.84                                                                          TZOR 08
0.        .08       .41       1.39      1.64      1.36      .73       -.12      -1.18     -2.39      TZOR 09
-3.71     -5.09     -6.55                                                                           TZOR 09
0.        -.08      -.35      -.36      .16       .4        .6        .72       .82       .91        TZOR 11
.97       1.02      1.05                                                                            TZOR 11
0.        -.08      -.35      -.36      .16       .4        .59       .72       .82       .92        TZOR 12
.97       1.02      1.05                                                                            TZOR 12
0.        -.08      -.35      -.61      -.85      -.92      -.9       -.71      -.4       -.01       TZOR 13
.52       1.13      1.77                                                                            TZOR 13
0.        .48       .89       1.07      1.27      1.4       1.48      1.52      1.55      1.44       WORD  2
1.14      .66       0.                                                                              WORD  2
0.        .54       .99       1.16      1.34      1.44      1.5       1.51      1.46      1.28       WORD  6
.98       .55       0.                                                                              WORD  6
0.        .49       .89       1.04      1.18      1.27      1.33      1.351     1.297     1.134      WORD  8
.864      .486      0.                                                                              WORD  8
0.        .47       .716      .879      1.065     1.192     1.292     1.329     1.276     1.116      WORD  9
.851      .478      0.                                                                              WORD  9
0.        .47       .723      .903      1.128     1.268     1.364     1.403     1.347     1.179      WORD 11
.898      .507      0.                                                                              WORD 11
0.        .056      .267      .505      .898      1.179     1.347     1.403     1.347     1.179      WORD 12
.898      .505      0.                                                                              WORD 12
0.        .056      .271      .512      .911      1.196     1.367     1.424     1.367     1.196      WORD 13
.911      .512      0.                                                                              WORD 13
0.0       120.      240.      360.      480.      600.      720.      840.      960.      1080.      XFUS 10
```

```
1200.  1320.  1440.  1560.  1680.  1920.  2120.  2240.  2360.  2480.      XFUS 20
2664.3 2720.  2840.  2960.  3080.  3200.  3320.  3440.  3524.             XFUS 30
-38.   -30.75 -23.75 -18.5  -16.2  -15.9  -17.2  -20.9  -26.84 -32.75     ZFUS 10
-36.73 -40.53 -45.07 -49.39 -53.68 -61.59 -68.9  -72.9  -75.0  -76.6      ZFUS 20
-76.8  -76.6  -74.9  -71.3  -66.7  -60.9  -53.3  -44.3  -37.              ZFUS 30
0.     830.   2875.  5242.  8136.  10944. 13752. 16128. 18547. 19584.     AFUS 10
19670. 19670. 20016. 20304. 20548. 20707. 20404. 20073. 19397. 18346.     AFUS 20
16272. 15408. 13248. 10483. 7085.  4464.  2477.  878.   0.                AFUS 30
2094.  214.   -34.                                                        PODORG 1
0.     137.   393.                                                        PODX 1
33.92  35.65  35.65                                                       PODR 1
2091.  204.   -136.                                                       PODORG 2
0.     136.   394.                                                        PODX 2
32.    35.65  35.65                                                       PODR 2
2480.  645.   -100.  194.5  2595.4 645.   -28.   241.1                    FINORG 1
0.     10.    20.    30.    40.    50.    60.    70.    90.    100.      XFIN
0.     .466   .846   1.138  1.345  1.465  1.498  1.390  .641   0.0       FINORD
3183.9 0.     -27.   294.1  3403.2 0.     66.5   67.7                     FINORG 2
0.     10.    20.    30.    40.    50.    60.    70.    90.    100.      XFIN
0.     .466   .846   1.138  1.345  1.465  1.498  1.390  .641   0.0       FINORD
3116.4 33.    -40.   283.8  3354.  174.4  -40.   76.4                     CANORG
0.0    10.    20.    30.    40.    50.    70.    80.    90.    100.      XCAN
0.0    .553   .948   1.264  1.448  1.5    1.264  .948   .553   0.0       CANORD
267 2550  50  20   0   00000000
268 1200  50  20   0   00000000
269 1000  50   1   0   01000000

INPUT DATA LISTED
```

```
CL1607-32  (-24 PLANFORM)  VC121 ENGINE
0         0         1          -0.0200     0.0       0.0       0.0    0        0
1              2.550
3              0.0       5.000    10.000
0              0.0       0.0       0.0       0.0       0.0
12       967680.00    1.0000       0.0       0.0  1290.0996
  944.0999   65.7400  -54.9600 1448.9399           WING PANEL NO. 1
 1462.5000  223.9400  -54.4700  925.9700           WING PANEL NO. 1
    3.0000   10.0000    1.0000       0.0           NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         0         0
       0.0    1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
       0.0   -0.0129   -0.1367   -0.4893   -1.2589   -1.9373   -2.4770   -2.8862
   -3.1954   -3.4439   -3.6668   -3.9008   -4.1644
       0.0    0.0529    0.2700    0.3078    0.1145   -0.2430   -0.6825   -1.1609
   -1.6545   -2.1469   -2.6232   -3.0692   -3.4807
 1462.5000  223.9400  -54.4700  925.9700           WING PANEL NO. 2
 1768.7998  317.4099  -69.0000  650.0098           WING PANEL NO. 2
    3.0000   10.0000    1.0000       0.0           NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         0         0
       0.0    1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
       0.0    0.0529    0.2700    0.3078    0.1145   -0.2430   -0.6825   -1.1609
   -1.6545   -2.1469   -2.6232   -3.0692   -3.4807
       0.0    0.0138    0.1708    0.3492    0.4138    0.3277    0.1538   -0.0785
   -0.3554   -0.6585   -0.9846   -1.3231   -1.6677
 1768.7998  317.4099  -69.0000  650.0098           WING PANEL NO. 3
 1905.3999  368.0398  -77.1600  529.8699           WING PANEL NO. 3
    3.0000   10.0000    1.0000       0.0           NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         0         0
       0.0    1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
       0.0    0.0138    0.1708    0.3492    0.4138    0.3277    0.1538   -0.0785
   -0.3554   -0.6585   -0.9846   -1.3231   -1.6677
       0.0    0.0151    0.0774    0.2623    0.3095    0.2567    0.1378   -0.0226
   -0.2227   -0.4511   -0.7002   -0.9606   -1.2362
 1905.3999  368.0398  -77.1600  529.8699           WING PANEL NO. 4
 2225.7998  486.8298  -89.7400  311.7200           WING PANEL NO. 4
    3.0000   10.0000    1.0000       0.0           NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         0         0
       0.0    1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
       0.0    0.0151    0.0774    0.2623    0.3095    0.2567    0.1378   -0.0226
   -0.2227   -0.4511   -0.7002   -0.9606   -1.2362
       0.0   -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1925    0.2310
    0.2631    0.2919    0.3112    0.3272    0.3368
 2225.7998  486.8298  -89.7400  311.7200           WING PANEL NO. 5
 2225.7998  486.8799  -89.7400  311.7700           WING PANEL NO. 5
    3.0000   10.0000    1.0000       0.0           NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         0         0
       0.0    1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
       0.0   -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1925    0.2310
    0.2631    0.2919    0.3112    0.3272    0.3368
       0.0   -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
 2225.7998  486.8799  -89.7400  311.7200           WING PANEL NO. 6
 2479.2998  645.0498  -99.9600  194.4500           WING PANEL NO. 6
    3.0000   10.0000    1.0000       0.0           NVOR,RNCV,SPC,PDL
       0.0       0.0 0         13        0         0         0
       0.0    1.0000    5.0000   10.0000   20.0000   30.0000   40.0000   50.0000
   60.0000   70.0000   80.0000   90.0000  100.0000
       0.0   -0.0257   -0.1123   -0.1155    0.0513    0.1283    0.1893    0.2310
    0.2631    0.2951    0.3112    0.3272    0.3368
       0.0   -0.0411   -0.1800   -0.3137   -0.4371   -0.4731   -0.4628   -0.3651
   -0.2057   -0.0051    0.2674    0.5811    0.9103
       0.0       0.0   45.7619 3524.0000           FUSELAGE PANEL
       0.0       0.0  -97.8677 3524.0000           FUSELAGE PANEL
    3.0000   28.0000    1.0000  999.0000           NVOR,RNCV,SPC,PDL
   90.0000   71.8148   33.1318   71.8148  -23.7363   71.8148  -90.0000   71.8148
```

```
       0.0       0.0 1         29        0         0         1
       0.0    3.4052    6.8104   10.2157   13.6209   17.0261   20.4313   23.8365
   27.2418   30.6470   34.0522   37.4574   40.8627   44.2679   47.6731   54.4835
   60.1589   63.5641   66.9693   70.3746   75.6044   77.1850   80.5902   83.9955
   87.4007   90.8059   94.2111   97.6163  100.0000
   -1.0783   -0.8726   -0.6739   -0.5250   -0.4597   -0.4512   -0.4881   -0.5931
   -0.7616   -0.9293   -1.0423   -1.1501   -1.2789   -1.4015   -1.5233   -1.7477
   -1.9552   -2.0687   -2.1283   -2.1737   -2.1793   -2.1737   -2.1254   -2.0233
   -1.8927   -1.7281   -1.5125   -1.2571   -1.0499
       0.0    5.1227   17.7443   32.3533   50.2150   67.5458   84.8766  100.0000
  100.0000  100.0000  100.0000  100.0000  100.0000  100.0000  100.0000  100.0000
  100.0000  100.0000  100.0000  100.0000  100.4297   95.0974   81.7659   64.7005
   43.7282   27.5516   15.2879    5.4190       0.0
 2094.0000  214.0000   -0.0800  393.0000          NACELLE PANEL NO 1
 2094.0000  214.0000   -0.0800  393.0000          NACFLLE PANEL NO 1
    6.0000    5.0000       0.0  999.0000          NVOR,RNCV,SPC,PDL
   90.0000   33.9200   30.0000   33.9200  -30.0000   33.9200  -90.0000   33.9200
 -150.0000   33.9200 -210.0000   33.9200 -270.0000   33.9200
       0.0       0.0 0         3         0         0         1
       0.0   12.1522  100.0000
     0.0
  100.0000  105.1001  105.1001
 2091.0000  204.0000 -104.0000  394.0000          NACELLE PANEL NO 2
 2091.0000  204.0000 -104.0000  394.0000          NACELLE PANEL NO 2
    6.0000    5.0000       0.0  999.0000          NVOR,RNCV,SPC,PDL
   90.0000   32.0000   30.0000   32.0000  -30.0000   32.0000  -90.0000   32.0000
 -150.0000   32.0000 -210.0000   32.0000 -270.0000   32.0000
       0.0       0.0 0         3         0         0         1
       0.0   11.9148  100.0000
     0.0
  100.0000  111.4062  111.4062
 2460.0000  645.0000 -100.0000  194.5000          FIN PANEL NO. 1
 2595.3999  645.0000  -28.0000  141.1000          FIN PANEL NO. 1
    2.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         0         0         0         0
 3183.8999       0.0  -27.0000  294.0999          FIN PANEL NO. 2
 3403.2030       0.0   66.5000   67.7000          FIN PANEL NO. 2
    2.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         0         0         0         0
 3116.3999   33.0000  -40.0000  283.7998          CANARD PANEL NO. 1
 3354.0000  174.4000  -40.0000   76.4000          CANARD PANEL NO. 1
    2.0000   10.0000    1.0000       0.0          NVOR,RNCV,SPC,PDL
       0.0       0.0 0         0         0         0         0
0         0         0                   NXS,NYS,NZS
```

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# APPENDIX D

## VORLAX TO WAVE DRAG INPUT CONVERSION PROGRAM (VORTWD)

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## SUMMARY

A program developed to convert the VORLAX input geometry description into the Wave Drag input geometry description has two purposes: 1) to permit plotting of the configuration geometry in wire frame form as a check on input errors; 2) to save time and reduce human drudgery when configurations for which the geometry was first digitized in the VORLAX format is also to be analyzed for wave drag.

While the present version of VORTWD does not convert all VORLAX input options, it does handle the most common ones. It is recommended that all newly created VORLAX data sets be converted and plotted to validate the input geometry.

## INTRODUCTION

In the analysis of an airplane design, what is basically the same geometric body is described by several different geometric models, each of which is unique to the discipline for which it is designed; yet at the same time there exist certain elements common to all models. For example, the NASA Wave Drag format (Reference 12) emphasizes the enclosed volume of the aircraft and correct spatial relationship of components while the VORLAX method of aerodynamic analysis uses a paneling procedure similar to but different in detail from the Wave Drag format.

The program described herein, called VORTWD is for direct transformation from VORLAX to Wave Drag input format. To accomplish this, certain data must be added to the VORLAX dataset to give the program sufficient "smarts" as to which VORLAX panels are associated with which Wave Drag components.

A companion program called WDTVOR converts data from the Wave Drag to VORLAX formats and is described in Appendix C.

Presently the VORTWD program is limited as to the types of VORLAX data sets it can handle as follows:

### WINGS

- Wings may have camber but not thickness.
- All wing panels must have the same number (NAP) and values (XAP) of percent chord stations for the camber definition. Flat wings without camber can also be handled.

- All wing panels must span the distance from leading to trailing edge of the wing. That is, separate panels representing leading or trailing edge flaps are not properly treated at present.

- Twist applied to a panel via AINC1 and AINC2 in VORLAX is ignored in the transformation.

FUSELAGE

- VORLAX fuselage simulations consisting of either a single trapezoidal panel of zero thickness or a curved panel having polygonal cross sections may be converted.

NACELLES

- Circular nacelles represented by curved panels in VORLAX can be converted. Nine is the maximum number of nacelles. Nacelles treated as vertical flat plates are better treated as fins.

FINS

- Zero thickness panels without camber are treated; one panel per fin maximum. Six is the maximum number of fins and fin panels.

CANARDS (Horizontal Tail)

- Zero thickness panels without camber are treated; one panel per canard maximum. Two is the minimum number of canards and canard panels.

Two plot control cards compatible with the Configuration Plot Program (Reference 1) are automatically added to the converted dataset.

## NOMENCLATURE

| Symbol | Description |
|---|---|
| NWNGP | Total number of VORLAX panels making up the wing description. If wing is cambered, then all panels must have the same number of percent chords (NAP) and the same values of percent chords (XAF) in the camber description. This is a Wave Drag requirement but not a VORLAX requirement. Input as an integer, no decimal point. Maximum value is 20. |

| Symbol | Description |
|---|---|
| NWING | VORLAX panel numbers making up the wing. VORLAX panels are numbered according to their input sequence, not by any alphanumeric description appearing to the right of the VORLAX data cards. Wing panel numbers need not be consecutive but they must be listed in a sequence proceeding from root to tip. Input as integers separated by commas. The maximum number of values is 20 and the number listed must be equal to the NWNGP value. |
| NFUSP | The total number of panels making up the fuselage. The fuselage is assumed to consist of only one major fuselage segment in terms of Wave Drag. Input one as an integer. |
| NFUSE | The VORLAX panel number describing the fuselage. |
| NP | Number of curved panels describing pods or engine nacelles. Maximum value is 9. |
| NPPAN | List of VORLAX panel numbers making up the pod or nacelle descriptions. One panel per pod. Presently, such panels should be curved panels, i.e., PDL >360. If a nacelle is being simulated as a vertical flat plate or plates, then it would be more appropriately treated as a fin or fins for Wave Drag purposes. |
| NF | Number of fins to be described. Symmetric fins need be described only once. Maximum value is 6. |
| NFPAN | List of VORLAX panel numbers making up the fin descriptions. Maximum number is 6 and number listed must be equal to the NF value. That is, one panel per fin. |
| NCAN | Number of canards (horizontal tails) to be described. Maximum value is 2. |
| NCANP | List of VORLAX panel numbers making up the canard (horizontal tail) descriptions. Maximum number is 2 and number listed must be equal to NCAN. That is one panel per canard. |
| PLOTSZ | The maximum dimension in inches of the plot to be made from the plot cards appended to the converted dataset. Same definition as PLOTSZ in the Configuration Plot program (Reference 1). |

## PROCEDURE

1. Create a VORLAX dataset if it does not exist already.

2. Add smarts cards to the front of the VORLAX dataset. A typical dataset with smarts cards included is shown in Figure D-1. Note that all such cards are input in namelist format in which nothing may be entered in column one; only columns 2 through 80 may be used. The first namelist card must contain &INPUT and the last card &END. Input quantities are input as VARIABLE NAME = VALUE, as shown in Figure D-1. Variables may be named in any order. Definitions for the various smarts variables are found in the nomenclature section.

3. Submit smartened dataset to the VORTWD conversion program. Figure D-2 shows the output resulting from conversion to Wave Drag format.

4. Validate the converted dataset by submitting it to the Configuration Plot program (Reference 1). Figure D-3 and D-4 shows the plotted results of the Figure D-2 dataset.

5. If the configuration is to be analyzed for Wave Drag; the converted dataset must be edited to supply thickness distributions for the wing and tail surfaces and if the VORLAX fuselage simulation was the single trapezoidal kind, then it must be given volume.

```
INPUT DATA LISTING FOLLOWS

 &INPUT
 NWNGP=5,NWING=1,2,3,4,5, NFUSP=1, NFUSE=6,NF=2,NFPAN=9,10,      SMARTS CARDS
 NCAN=1,NCANP=11,NP=2,NPPAN=7,8, PLOTSZ=10.,
 &END
CL1607-32    (-24 PLANFORM)  VC121 ENGINE
0            0         1               -0.0200      0.0          0.0          0.0     0        0
1                2.550
3                0.0         5.000     10.000
0                0.0         0.0        0.0          0.0          0.0
11           967680.00       1.0000     0.0          0.0       1290.0996
   944.0999     65.7400    -54.9600  1448.9399               WING PANEL NO. 1
  1462.5000    223.9400    -54.4700   925.9700               WING PANEL NO. 1
     3.0000     10.0000      1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0         0.0     0          13          0            0          0
     0.0         1.0000      5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
    60.0000     70.0000     80.0000    90.0000   100.0000
     0.0        -0.0129     -0.1367    -0.4893    -1.2589    -1.9373    -2.4770    -2.8862
    -3.1954     -3.4439     -3.6668    -3.9008    -4.1644
     0.0         0.0529      0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
    -1.6545     -2.1469     -2.6232    -3.0692    -3.4807
  1462.5000    223.9400    -54.4700   925.9700               WING PANEL NO. 2
  1768.7998    317.4099    -69.0000   650.0098               WING PANEL NO. 2
     3.0000     10.0000      1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0         0.0     0          13          0            0          0
     0.0         1.0000      5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
    60.0000     70.0000     80.0000    90.0000   100.0000
     0.0         0.0529      0.2700     0.3078     0.1145    -0.2430    -0.6825    -1.1609
    -1.6545     -2.1469     -2.6232    -3.0692    -3.4807
     0.0         0.0138      0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
    -0.3554     -0.6585     -0.9846    -1.3231    -1.6677
  1768.7998    317.4099    -69.0000   650.0098               WING PANEL NO. 3
  1905.3999    368.0398    -77.1600   529.8699               WING PANEL NO. 3
     3.0000     10.0000      1.0000     0.0                  NVOR,RNCV;SPC,PDL
     0.0         0.0     0          13          0            0          0
     0.0         1.0000      5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
    60.0000     70.0000     80.0000    90.0000   100.0000
     0.0         0.0138      0.1708     0.3492     0.4138     0.3277     0.1538    -0.0785
    -0.3554     -0.6585     -0.9846    -1.3231    -1.6677
     0.0         0.0151      0.0774     0.2623     0.3095     0.2567     0.1378    -0.0226
    -0.2227     -0.4511     -0.7002    -0.9606    -1.2362
  1905.3999    368.0398    -77.1600   529.8699               WING PANEL NO. 4
  2225.7998    486.8298    -89.7400   311.7200               WING PANEL NO. 4
     3.0000     10.0000      1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0         0.0     0          13          0            0          0
```

Figure D-1.- VORLAX dataset with smarts cards included

```
       0.0     1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
   60.0000    70.0000    80.0000    90.0000   100.0000
       0.0     0.0151     0.0774     0.2623     0.3095     0.2567     0.1378    -0.0226
   -0.2227    -0.4511    -0.7002    -0.9606    -1.2362
       0.0    -0.0257    -0.1123    -0.1155     0.0513     0.1283     0.1925     0.2310
    0.2631     0.2919     0.3112     0.3272     0.3368
 2225.7998   486.8799   -89.7400   311.7200             WING PANEL NO. 6
 2479.2998   645.0498   -99.9600   194.4500             WING PANEL NO. 6
    3.0000    10.0000     1.0000        0.0             NVOR,RNCV,SPC,PDL
       0.0        0.0  0         13         0          0          0
       0.0     1.0000     5.0000    10.0000    20.0000    30.0000    40.0000    50.0000
   60.0000    70.0000    80.0000    90.0000   100.0000
       0.0    -0.0257    -0.1123    -0.1155     0.0513     0.1283     0.1893     0.2310
    0.2631     0.2951     0.3112     0.3272     0.3368
       0.0    -0.0411    -0.1800    -0.3137    -0.4371    -0.4731    -0.4628    -0.3651
   -0.2057    -0.0051     0.2674     0.5811     0.9103
       0.0        0.0    45.7619  3524.0000             FUSELAGE PANEL
       0.0        0.0   -97.8677  3524.0000             FUSELAGE PANEL
    4.0000    28.0000     1.0000   999.0000             NVOR,RNCV,SPC,PDL
   90.0000    71.8148    52.0879    71.8148    14.1758    71.8148   -23.7363    71.8148
  -90.0000    71.8148
       0.0        0.0  1         29         0          0          1
       0.0     3.4052     6.8104    10.2157    13.6209    17.0261    20.4313    23.8365
   27.2418    30.6470    34.0522    37.4574    40.8627    44.2679    47.6731    54.4835
   60.1589    63.5641    66.9693    70.3746    75.6044    77.1850    80.5902    83.9955
   87.4007    90.8059    94.2111    97.6163   100.0000
   -1.0783    -0.8726    -0.6739    -0.5250    -0.4597    -0.4512    -0.4881    -0.5931
   -0.7616    -0.9293    -1.0423    -1.1501    -1.2789    -1.4015    -1.5233    -1.7477
   -1.9552    -2.0687    -2.1283    -2.1737    -2.1793    -2.1737    -2.1254    -2.0233
   -1.8927    -1.7281    -1.5125    -1.2571    -1.0499
       0.0     5.1227    17.7443    32.3533    50.2150    67.5458    84.8766   100.0000
  100.0000   100.0000   100.0000   100.0000   100.0000   100.0000   100.0000   100.0000
  100.0000   100.0000   100.0000   100.0000   100.4297    95.0974    81.7659    64.7005
   43.7282    27.5516    15.2879     5.4190        0.0
 2094.0000   214.0000    -0.0800   393.0000             NACELLE PANEL NO 1
 2094.0000   214.0000    -0.0800   393.0000             NACELLE PANEL NO 1
    8.0000     5.0000        0.0   999.0000             NVOR,RNCV,SPC,PDL
   90.0000    33.9200    45.0000    33.9200        0.0    33.9200   -45.0000    33.9200
  -90.0000    33.9200  -135.0000    33.9200  -180.0000    33.9200  -225.0000    33.9200
 -270.0000    33.9200
       0.0        0.0  0          3         0          0          1
       0.0    12.1522   100.0000
       0.0
  100.0000   105.1001   105.1001
```

Figure D-1.- Continued

```
  2091.0000   204.0000  -104.0000   394.0000             NACELLE PANEL NO 2
  2091.0000   204.0000  -104.0000   394.0000             NACELLE PANEL NO 2
     8.0000     5.0000     0.0      999.0000             NVOR,RNCV,SPC,PDL
    90.0000    32.0000    45.0000    32.0000      0.0        32.0000   -45.0000    32.0000
   -90.0000    32.0000  -135.0000    32.0000  -180.0000      32.0000  -225.0000    32.0000
  -270.0000    32.0000
     0.0        0.0     0          3          0          0          1
     0.0       11.9148   100.0000
     0.0
   100.0000   111.4062   111.4062
  2480.0000   645.0000  -100.0000   194.5000             FIN PANEL NO. 1
  2595.3999   645.0000   -28.0000   141.1000             FIN PANEL NO. 1
     2.0000    10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
     0.0        0.0     0          0          0           0          0
  3183.8999     0.0      -27.0000   294.0999             FIN PANEL NO. 2
  3403.2000     0.0       66.5000    67.7000             FIN PANEL NO. 2
     2.0000    10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
     0.0        0.0     0          0          0           0          0
  3116.3999    33.0000   -40.0000   283.7998             CANARD PANEL NO. 1
  3354.0000   174.4000   -40.0000    76.4000             CANARD PANEL NO. 1
     2.0000    10.0000     1.0000     0.0                NVOR,RNCV,SPC,PDL
     0.0        0.0     0          0          0           0          0
 0          0          0                    NXS,NYS,NZS

INPUT DATA LISTED
```

Figure D-1.- Concluded

```
CL1607-32   (-24 PLANFORM)  VC121 ENGINE
  1  1 -1  1  1  1  0  6 13  1  5 29  0  0  0  0  0  0  2  3  2  2  1  2
 967680                                                                  REFA
   0.0     1.00     5.00   10.00   20.00   30.00   40.00   50.00   60.00   70.00   XAF
  80.00   90.00   100.00
 944.10   65.74  -54.961448.94                                                     WORG
1462.50  223.94  -54.47  925.97                                                    WORG
1768.80  317.41  -69.00  650.01                                                    WORG
1905.40  368.04  -77.16  529.87                                                    WORG
2225.80  486.88  -89.74  311.72                                                    WORG
2479.30  645.05  -99.96  194.45                                                    WORG
   0.0    -0.19   -1.98   -7.09  -18.24  -28.07  -35.89  -41.82  -46.30  -49.90   TZORD
 -53.13  -56.52  -60.34
   0.0     0.49    2.50    2.85    1.06   -2.25   -6.32  -10.75  -15.32  -19.88   TZORD
 -24.29  -28.42  -32.23
   0.0     0.09    1.11    2.27    2.69    2.13    1.00   -0.51   -2.31   -4.28   TZORD
  -6.40   -8.60  -10.84
   0.0     0.08    0.41    1.39    1.64    1.36    0.73   -0.12   -1.18   -2.39   TZORD
  -3.71   -5.09   -6.55
   0.0    -0.08   -0.35   -0.36    0.16    0.40    0.59    0.72    0.82    0.92   TZORD
   0.97    1.02    1.05
   0.0    -0.08   -0.35   -0.61   -0.85   -0.92   -0.90   -0.71   -0.40   -0.01   TZORD
   0.52    1.13    1.77
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    WORD
   0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    WORD
   0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    WORD
   0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    WORD
   0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    WORD
   0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    WORD
   0.0     0.0     0.0
    0.0  120.00  240.00  360.00  480.00  600.00  720.00  840.00  960.001080.00   XFUS
1200.001320.001440.001560.001680.001920.002120.002240.002360.002480.00   XFUS
2664.302720.002840.002960.003080.003200.003320.003440.003524.00
 -38.00 -30.75 -23.75 -18.50 -16.20 -15.90 -17.20 -20.90 -26.84 -32.75   ZFUS
 -36.73 -40.53 -45.07 -49.39 -53.68 -61.59 -68.90 -72.90 -75.00 -76.60   ZFUS
 -76.80 -76.60 -74.90 -71.30 -66.70 -60.90 -53.30 -44.30 -37.00
    0.0  830.0 2875.0 5242.0 8136.010944.013752.016202.316202.316202.3   AFUS
16202.316202.316202.316202.316202.316202.316202.316202.316202.316202.3   AFUS
16271.915408.013248.010483.0 7085.0 4464.0 2477.0  878.0    0.0
```

Figure D-2.- WAVE DRAG format dataset resulting from conversion

---

```
2094.00 214.00   -0.08                                                               PODORG 1
   0.0   47.76 393.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0        XPOD   1
  33.92  34.77  34.77     0.0     0.0     0.0     0.0     0.0     0.0     0.0        PODORD 1
2091.00 204.00-104.00                                                                PODORG 2
   0.0   46.94 394.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0        XPOD   2
  32.00  33.78  33.78     0.0     0.0     0.0     0.0     0.0     0.0     0.0        PODORD 2
 2480.0  645.0 -100.0   194.5  2595.4   645.0   -28.0   141.1                        FINORG
    0.0  100.0                                                                       XFIN
    0.0    0.0                                                                       FINORD
 3183.9    0.0  -27.0   294.1  3403.2     0.0    66.5    67.7                        FINORG
    0.0  100.0                                                                       XFIN
    0.0    0.0                                                                       FINORD
 3116.4   33.0  -40.0   283.8  3354.0   174.4   -40.0    76.4                        CANORG
    0.0  100.0                                                                       XCAN
    0.0    0.0                                                                       CANORD
X Y                                                  10.000RT
X Z      26.62-24.139.23                             12.250RT                    1
```

Figure D-2.- Concluded

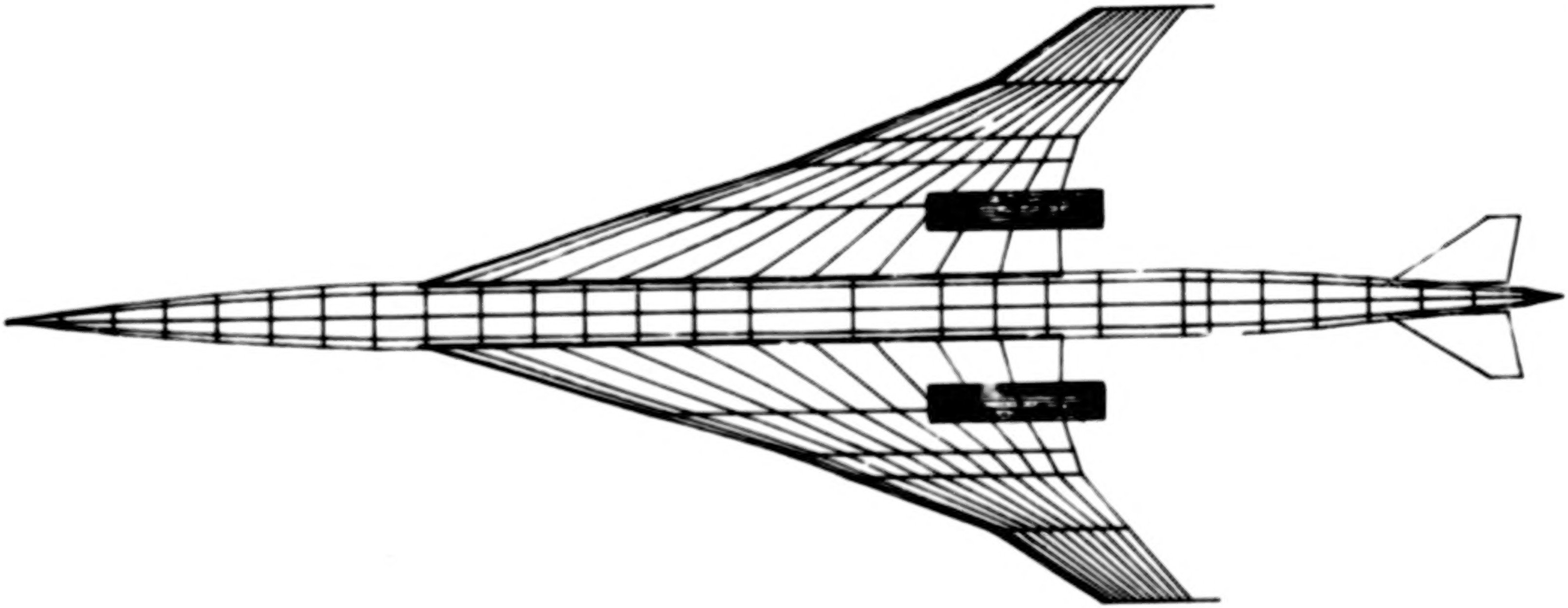

Figure D-3.- Planform plot from figure D-2 dataset

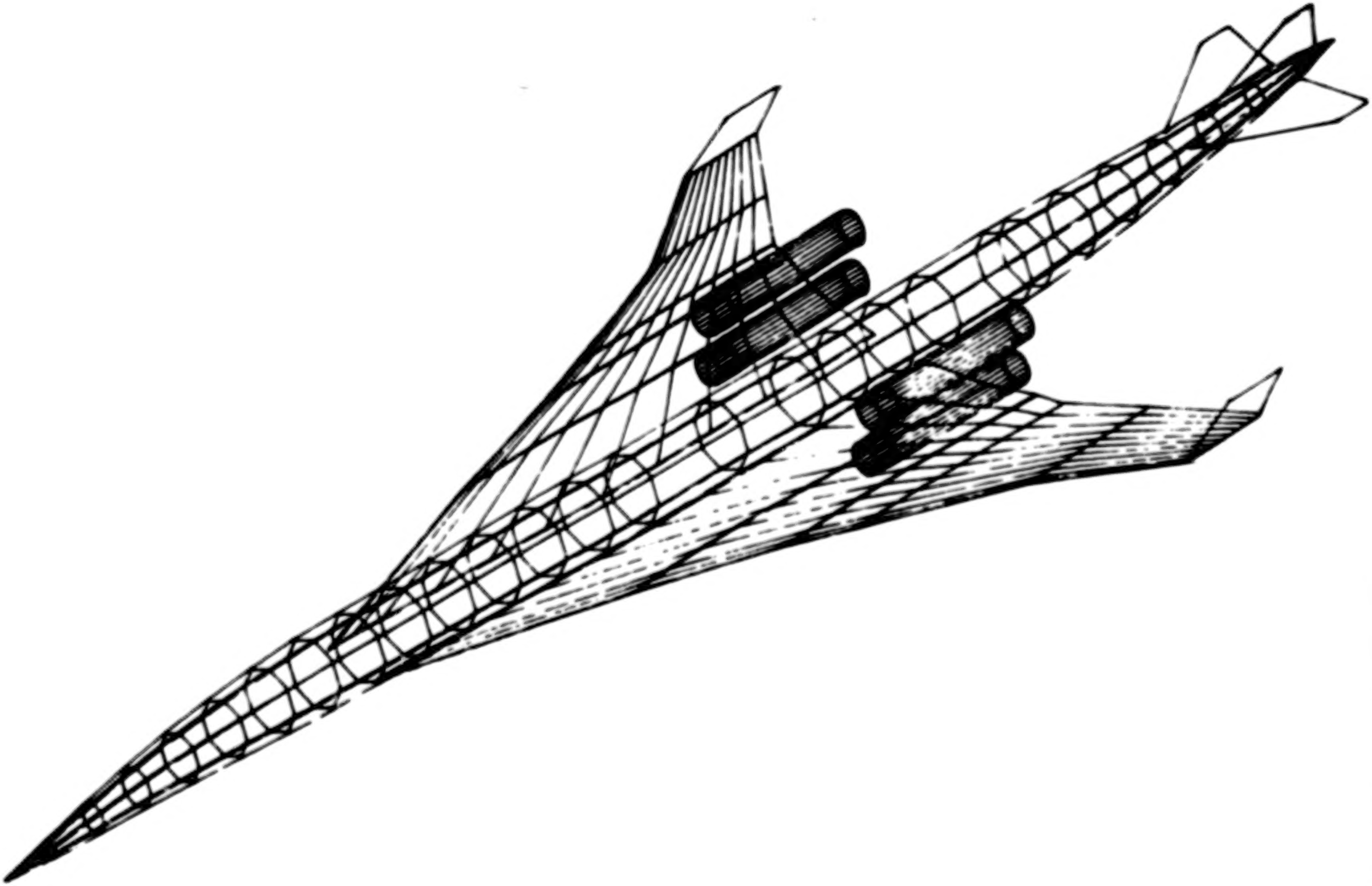

Figure D-4.- Isometric plot from figure D-2 dataset

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PROGRAM

VORLAX TO WAVE DRAG
INPUT CONVERSION PROGRAM
(VORTWD)

COMPLETE COMPILE
AND EXECUTION
IN IBM FORTRAN IV LEVEL H

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LEVEL 21.8 ( JUN 74 )                        OS/360  FORTRAN H                                   DATE  77.061/21.16.02
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```
      COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                             SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
            CONTROL*VRLX.VORTWON                                                9/21/76 00000010
            C...                                                                        00000020
            C... PROGRAM TO CONVERT DATA FROM VORLAY PROGRAM OUTPUT  INTO               00000030
            C...WAVEDRAG INPUT.  THERE ARE MANY RESTRICTIONS IN THIS CONVERSION         00000040
            C...AND THE USERS GUIDE SHOULD BE CONSULTED FOR AN EXPLANATION.             00000050
            C...                                                                        00000060
ISN 0002          DIMENSION NWING (20), II (24), NAPX (40), XYZC2 (4, 40),              00000070
                * ZC12 (2, 30, 40), XAPX (30, 40), NFUSE (6), YFUS (6, 30),             00000080
                * ZFUS (6, 30), XFUS (30), ABCD (6, 2, 4), NFPAN (6), XFIN (10),        00000090
                * FINORD(10), XCAN(10), CANORD(10), NCANP(2), NPPAN(9), RHO(20),        00000100
                * PODORG (3), PHEE (20), XPOD (9,10), PODORD (9,10), NPP(20)            00000110
ISN 0003          NAMELIST/INPUT/NWNGP, NWING, NFUSP, NFUSE, NF, NFPAN, NCAN, NCANP     00000120
                *, PLOTSZ, NP, NPPAN                                                    00000130
ISN 0004      10  FORMAT (20A4)                                                         00000140
ISN 0005      20  FORMAT (1H1, 20A4)                                                    00000150
ISN 0006          DIMENSION XAF (50), ZC1 (50), ZC2 (50), AFUS(30), ZFUSS(30)           00000160
ISN 0007          DIMENSION DESCRP (10), ALPHA (8), PHI (51), RO (51), CURV (40),       00000170
                * TITLE (20), XS (20), C1 (20), C2 (20)                                 00000180
ISN 0008          REAL*4 MACH, NVOR, LESWP                                              00000190
ISN 0009          COMMON /SET4 /AINC1 (20), AINC2 (20)                                  00000200
ISN 0010          COMMON /SET5 /XAPEX (40), YAPEX (40), ZAPEX (40), PDL (40),           00000210
                * LESWP (40), SYNTH (40), IQUANT (40)                                   00000220
ISN 0011          COMMON /SET7 /RNCV (20), ITS (20)                                     00000230
ISN 0012          COMMON /SET12 /CS[illegible]T (40), TAPER (40), PSPAN (40), NVOR (40) 00000240
ISN 0013          COMMON /SET13 /MACH (8)                                               00000250
ISN 0014          COMMON /SET23 /SLE1 (20), SLE2 (20), SPC (40)                         00000260
ISN 0015          CALL LSTDT8                                                           00000270
ISN 0016          PI = 3.14159                                                          00000280
ISN 0017      30  L3 = 3                                                                00000290
ISN 0018          DO 40 I = 1, 10                                                       00000300
ISN 0019          XFIN (I) = 0.                                                         00000310
ISN 0020          FINORD (I) = 0.                                                       00000320
ISN 0021          XCAN (I) = 0.                                                         00000330
ISN 0022          CANORD (I) = 0.                                                       00000340
ISN 0023          IF (I .LE. 6) XFUS (I) = 0.                                           00000350
ISN 0025      40  CONTINUE                                                              00000360
ISN 0026          DO 50 I = 1, 30                                                       00000370
ISN 0027          DO 50 J = 1, 6                                                        00000380
ISN 0028          XFUS (I) = 0.                                                         00000390
ISN 0029          AFUS (I) = 0.                                                         00000400
ISN 0030          VFUS (J, I) = 0.                                                 00000410
ISN 0031          ZFUS (J, I) = 0.                                                 00000420
ISN 0032     50   CONTINUE                                                         00000430
ISN 0033          DO 60 I = 1, 6                                                   00000440
ISN 0034          DO 60 J = 1, 2                                                   00000450
ISN 0035          DO 60 K = 1, 4                                                   00000460
ISN 0036          ABCD (I, J, K) = 0.                                              00000470
ISN 0037     60   CONTINUE                                                         00000480
ISN 0038          DO 70 I = 1, 2                                                   00000490
ISN 0039          DO 70 J = 1, 30                                                  00000500
ISN 0040          DO 70 K = 1, 40                                                  00000510
ISN 0041          ZC12 (I, J, K) = 0.                                              00000520
ISN 0042     70   CONTINUE                                                         00000530
ISN 0043          NWWGP = 0                                                        00000540
ISN 0044          NF = 0                                                           00000550
ISN 0045          NCAN = 0                                                         00000560
ISN 0046          NFUSP = 0                                                        00000570
ISN 0047           NP=0                                                            00000572
ISN 0048           NPPAN(1)=0                                                      00000574
ISN 0049          DTR = .017453                                                    00000580
ISN 0050          PLOTSZ = 10.                                                     00000590
ISN 0051          READ (5, INPUT,END=940)                                          00000600
ISN 0052          READ (5, 10) TITLE                                               00000620
ISN 0053          WRITE (L3, 10) TITLE                                             00000630
ISN 0054          READ (5, 80) ISOLV, LAX, LAY, REXPAR, HAG, FLOATX, FLOATY, ITRMAX 00000640
ISN 0055     80   FORMAT (3 (I2, 8X), 4F10.0, 7X, I3)                              00000650
ISN 0056          READ (5, 90) NMACH, (MACH (I), I = 1, NMACH)                     00000660
ISN 0057     90   FORMAT (I2, 8X, 7F10.0)                                          00000670
ISN 0058          WRITE (6, 20) TITLE                                              00000680
ISN 0059          READ (5, 90) NALPHA, (ALPHA (I), I = 1, NALPHA)                  00000690
ISN 0060          READ (5, 90) LATRAL, PSI, PITCHQ, ROLLQ, YAWQ, VINF              00000700
ISN 0061          IF (PSI .NE. 0.) LATRAL = 1                                      00000710
ISN 0063          IF (ROLLQ .NE. 0.) LATRAL = 1                                    00000720
ISN 0065          IF (YAWQ .NE. 0.) LATRAL = 1                                     00000730
ISN 0067          IF (VINF .LE. 0.001) VINF = 1.0                                  00000740
ISN 0069          READ (5, 100) NPAN, SREF, CBAR, XBAR, ZBAR, WSPAN                00000750
ISN 0070    100   FORMAT (I2, 8X, 5F10.0)                                          00000760
ISN 0071          IF (WSPAN .LE. 0.0001) WSPAN = 2.0                               00000770
           C                                                                       00000780
ISN 0073    110   FORMAT (8F10.0)                                                  00000790
ISN 0074          INVERS = 0                                                       00000800
ISN 0075          DO 200 I = 1, NPAN                                               00000810
ISN 0076          READ (5, 120) X1, Y1, Z1, CORD1, DESCRP                          00000820
ISN 0077          READ (5, 120) X2, Y2, Z2, CORD2, DESCRP                          00000830
ISN 0078          XYZC2 (1, I) = X2                                                00000840
ISN 0079          XYZC2 (2, I) = Y2                                                00000850
ISN 0080          XYZC2 (3, I) = Z2                                                00000860
ISN 0081          XYZC2 (4, I) = CORD2                                             00000870
ISN 0082          READ (5, 120) NVOR (I), RNCV (I), SPC (I), CURV (I), DESCRP      00000880
ISN 0083          PDL (I) = 0.                                                     00000890
ISN 0084          IF (CURV (I) .NE. 0.) PDL (I) = 999.                             00000900
ISN 0086          IF (CURV (I) .GT. 500.0) CURV (I) = 0.0                          00000910
ISN 0088    120   FORMAT (4F10.0, 10A4)                                            00000920
ISN 0089            INTRAC = 1                                                      00000930
ISN 0090            IF (PDL (I)  .EQ. 0.) INTRAC = 0                                00000940
ISN 0092            XAPEX (I) = X1                                                  00000950
ISN 0093            YAPEX (I) = Y1                                                  00000960
ISN 0094            ZAPEX (I) = Z1                                                  00000970
ISN 0095            CSTART (I) = CORD1                                              00000980
ISN 0096            DELTAY = Y2 - Y1                                                00000990
ISN 0097            DELTAZ = Z2 - Z1                                                00001000
ISN 0098            IF (INTRAC .EQ. 0) PDL (I) = 1./DTR *ATAN2 (DELTAZ, DELTAY)     00001010
ISN 0100            IF (INTRAC .EQ. 0) GO TO 150                                    00001020
ISN 0102            NV = NVOR (I)                                                   00001030
ISN 0103            IBOT = 1                                                        00001040
ISN 0104            IF (I .EQ. 1) GO TO 140                                         00001050
ISN 0106            ITOP = I - 1                                                    00001060
ISN 0107            DO 130 J = 1, ITOP                                              00001070
ISN 0108            INV = NVOR (J)                                                  00001080
ISN 0109            IBOT = IBOT + INV                                               00001090
ISN 0110       130  CONTINUE                                                        00001100
ISN 0111       140  ITOP = IBOT + NV - 1                                            00001110
ISN 0112            JJTOP = NVOR (I) + 1                                            00001120
ISN 0113            READ (5, 110) (PHI (JJ), RO (JJ), JJ = 1, JJTOP)                00001130
ISN 0114            PHEE (I) = PHI (1)                                              00001140
ISN 0115            RHO (I) = RO (1)                                                00001150
ISN 0116       150  READ (5, 160) AINC1 (I), AINC2 (I), ITS (I), NAP, IQUANT(I),    00001160
                   * ISYNT, NPP (I)                                                 00001170
ISN 0117            NAPX (I) = NAP                                                  00001180
ISN 0118       160  FORMAT (2F10.0, 5 (I2, 8X))                                     00001190
ISN 0119            SYNTH (I) = ISYNT                                               00001200
ISN 0120            MAX = RNCV (I)                                                  00001210
ISN 0121            IF (ISYNT .EQ. 0) GO TO 170                                     00001220
ISN 0123            READ (5, 110) (C1 (K), K = 1, MAX)                              00001230
ISN 0124            READ (5, 110) (C2 (K), K = 1, MAX)                              00001240
ISN 0125            INVERS = 1                                                      00001250
ISN 0126            SLE1 (I) = 0.                                                   00001260
ISN 0127            SLE2 (I) = 0.                                                   00001270
ISN 0128            GO TO 200                                                       00001280
ISN 0129       170  IF (NAP .LT. 3) GO TO 200                                       00001290
ISN 0131            ILE = ITS (I) *(1 - INTRAC)                                     00001300
ISN 0132            RLE1 = 0.0                                                      00001310
ISN 0133            RLE2 = 0.0                                                      00001320
ISN 0134            READ (5, 110) (XAP (JJ), JJ = 1, NAP)                           00001330
ISN 0135            DO 180 JJ = 1, NAP                                              00001340
ISN 0136       180  XAPX (JJ, I) = XAP (JJ)                                         00001350
ISN 0137            IF  (ILE .NE. 0) READ (5, 110) RLE1                             00001360
ISN 0139            READ (5, 110) (ZC1 (JJ), JJ = 1, NAP)                           00001370
ISN 0140            IF (ILE .NE. 0) READ (5, 110) RLE2                              00001380
ISN 0142            READ (5, 110) (ZC2 (JJ), JJ = 1, NAP)                           00001390
ISN 0143            DO 190 JJ = 1, NAP                                              00001400
ISN 0144            ZC12 (1, JJ, I) = ZC1 (JJ)                                      00001410
ISN 0145       190  ZC12 (2, JJ, I) = ZC2 (JJ)                                      00001420
ISN 0146       200  CONTINUE                                                        00001430
ISN 0147            READ (5, 210) NXS, NYS, NZS                                     00001440
ISN 0148       210  FORMAT (3 (I2, 8X))                                             00001450
ISN 0149          IF (NXS .GT. 0) READ (5, 110) (XS (I), I = 1, NXS)                00001460
ISN 0151          IF (NXS .GT. 0) READ (5, 110) YNOT, DELTAY, ZNOT, DELTAZ          00001470
ISN 0153          DO 220 I = 1, 24                                                  00001480
ISN 0154          II (I) = 0                                                        00001490
ISN 0155     220  CONTINUE                                                          00001500
ISN 0156          II (1) = 1                                                        00001510
ISN 0157          IF (NWNGP .GT. 0) II (2) = 1                                      00001520
ISN 0159          IF (NWNGP .GT. 0) NAP = NAPX (NWING (1))                          00001530
ISN 0161          IF (NFUSP .GT. 0) II (3) = 1                                      00001540
ISN 0163          IF (PDL (NFUSE (1)) .GT. 360.)  II (3) = -1                       00001550
ISN 0165          IF (NWNGP .GT. 0) II (8) = NWNGP + 1                              00001560
ISN 0167          II (10) = 1                                                       00001570
ISN 0168          IF (NFUSP .EQ. 0) GO TO 230                                       00001580
ISN 0170          IB = NFUSE (1)                                                    00001590
ISN 0171          IF (PDL (IB) .EQ. 0) II (11) = 3                                  00001600
ISN 0173          IF (PDL (IB) .GT. 360.) II (11) = NVOR (IB) + 1                   00001610
ISN 0175          ITNOSE = 0                                                        00001620
ISN 0176          ITAFT = 0                                                         00001630
ISN 0177          IF (ABS ((XYZC2 (1, IB) - XAPEX (IB))) .GE. .01) ITNOSE = 1       00001640
ISN 0179          IF (ABS((XYZC2(1,IB)+XYZC2(4,IB))-(XAPEX(IB)+CSTART(IB))).GE.01)  00001650
                 * ITAFT = 1                                                        00001660
ISN 0181     230  IF (NWNGP .GT. 0) II (9) = NAP                                    00001670
ISN 0183          IF (NAPX(NWING(1)) .EQ. 0) II (9) = 2                             00001680
ISN 0185          IF (II (9) .EQ. 2) NAP = 2                                        00001690
ISN 0187          IF (NFUSP .GT. 0 .AND. PDL(IB) .LT. 360.) II(12)= 2+ITNOSE+ITAFT  00001700
ISN 0189          IF (PDL (IB) .GT. 360.) II (12) = NAPX (IB)                       00001710
ISN 0191          IF (NF .GT. 0) II (5) = 1                                         00001720
ISN 0193          II (21) = NF                                                      00001730
ISN 0194          IF (NF .GT. 0) II (22) = 2                                        00001740
ISN 0196          IF (NCAN .GT. 0) II (6) = 1                                       00001750
ISN 0198          II (23) = NCAN                                                    00001760
ISN 0199          IF (NCAN .GT. 0) II (24) = 2                                      00001770
ISN 0201          IF (NP .GT. 0) II (4) = 1                                         00001780
ISN 0203          II (19) = NP                                                      00001790
ISN 0204          IF (NP .GT. 0) NPODOR = NAPX (NPPAN (1))                          00001800
ISN 0206          IF (NP .GT. 0) II (20) = NPODOR                                   00001810
ISN 0208          WRITE (L3, 480) II                                                00001820
ISN 0209          WRITE (6, 610) II                                                 00001830
ISN 0210          ISREF = SREF                                                      00001840
ISN 0211          WRITE (L3, 490) ISREF                                             00001850
ISN 0212          WRITE (6, 620) ISREF                                              00001860
ISN 0213          IF (NWNGP .EQ. 0) GO TO 290                                       00001870
ISN 0215          IF (II (9) .NE. 2) GO TO 240                                      00001880
ISN 0217          XAFX (1, NWING (1)) = 0.                                          00001890
ISN 0218          XAFX (2, NWING (1)) = 100.                                        00001900
ISN 0219     240  WRITE (L3, 500) (XAFX (JJ, NWING (1)), JJ = 1, NAP)               00001910
ISN 0220          WRITE (6, 630) (XAFX (JJ, NWING (1)), JJ = 1, NAP)                00001920
ISN 0221          DO 250 I = 1, NWNGP                                               00001930
ISN 0222          IW = NWING (I)                                                    00001940
ISN 0223          WRITE (6, 640) XAPEX (IW), YAPEX (IW), ZAPEX (IW), CSTART (IW)    00001950
ISN 0224     250  WRITE (L3, 510) XAPEX (IW), YAPEX (IW), ZAPEX (IW), CSTART (IW)   00001960
ISN 0225          IWT = NWING (NWNGP)                                               00001970
ISN 0226          WRITE (L3, 510) (XYZC2 (I, IWT), I = 1, 4)                        00001980
ISN 0227          WRITE (6, 640) (XYZC2 (I, IWT), I = 1, 4)                        00001990
ISN 0228          ZERO = 0.                                                        00002000
ISN 0229          DO 270 I = 1, NWNGP                                              00002010
ISN 0230          IW = NWING (I)                                                   00002020
ISN 0231          DO 260 JJ = 1, NAP                                               00002030
ISN 0232          ZC12 (1, JJ, IW) = ZC12 (1, JJ, IW) *CSTART (IW) /100.           00002040
ISN 0233          ZC12 (2, JJ, IW) = ZC12 (2, JJ, IW) *XYZC2 (4, IW) /100.         00002050
ISN 0234     260  CONTINUE                                                         00002060
ISN 0235          WRITE (L3, 520) (ZC12 (1, JJ, IW), JJ = 1, NAP)                  00002070
ISN 0236          WRITE (6, 650) (ZC12 (1, JJ, IW), JJ = 1, NAP)                   00002080
ISN 0237     270  CONTINUE                                                         00002090
ISN 0238          WRITE (L3, 520) (ZC12 (2, JJ, IW), JJ = 1, NAP)                  00002100
ISN 0239          WRITE (6, 650) (ZC12 (2, JJ, IW), JJ = 1, NAP)                   00002110
ISN 0240          NWNGP1 = NWNGP + 1                                               00002120
ISN 0241          DO 280 I = 1, NWNGP1                                             00002130
ISN 0242          WRITE (6, 660) (ZERO, JJ = 1, NAP)                               00002140
ISN 0243          WRITE (L3, 530) (ZERO, JJ = 1, NAP)                              00002150
ISN 0244     280  CONTINUE                                                         00002160
            C                                                                      00002170
            C   GETTING THE X VALUES FOR THE FUSELAGE                              00002180
            C                                                                      00002190
ISN 0245     290  NFORX = II (12)                                                  00002200
ISN 0246          IF (NFUSP  .EQ. 0) GO TO 370                                     00002210
ISN 0248          IB = NFUSE (1)                                                   00002220
ISN 0249          IF (PDL (IB) .GT. 360.) GO TO 330                                00002230
ISN 0251          XFUS (1) = XAPEX (IB)                                            00002240
ISN 0252          IF (ITNOSE .GT. 0) XFUS (2) = XYZC2 (1, IB)                      00002250
ISN 0254          XFEND = XYZC2 (1, IB) + XYZC2 (4, IB)                            00002260
ISN 0255          IF (ITNOSE .GT. 0 .AND. ITAFT .GT. 0) XFUS (3) = XFEND           00002270
ISN 0257          IF (ITNOSE .EQ. 0 .AND. ITAFT .GT. 0) XFUS (2) = XFEND           00002280
ISN 0259          XFUS (NFORX) = XAPEX (IB) + CSTART (IB)                          00002290
ISN 0260          NWDS = NFORX                                                     00002300
ISN 0261          IF (NFORX .LT. 6) NWDS = 6                                       00002310
ISN 0263          WRITE (L3, 540) (XFUS (JJ), JJ = 1, NWDS)                        00002320
ISN 0264          WRITE (6, 670) (XFUS (JJ), JJ = 1, NWDS)                         00002330
            C                                                                      00002340
            C   GETTING THE Y & Z VALUES FOR THE FUSELAGE                          00002350
            C                                                                      00002360
ISN 0265          YFUS (1, 1) = YAPEX (IB)                                         00002370
ISN 0266          YFUS (1, 2) = XYZC2 (2, IB)                                      00002380
ISN 0267          IF (ITNOSE .GT. 0) YFUS (1, 2) = YAPEX (IB)                      00002390
ISN 0269          YFUS (1, 3) = YAPEX (IB)                                         00002400
ISN 0270          ZFUS (1, 1) = ZAPEX (IB)                                         00002410
ISN 0271          ZFUS (1, 2) = XYZC2 (3, IB)                                      00002420
ISN 0272          IF (ITNOSE .GT. 0) ZFUS (1, 2) = ZAPEX (IB)                      00002430
ISN 0274          ZFUS (1, 3) = ZAPEX (IB)                                         00002440
ISN 0275          IF (ITNOSE .EQ. 0) GO TO 300                                     00002450
ISN 0277          YFUS (2, 1) = YAPEX (IB)                                         00002460
ISN 0278          YFUS (2, 2) = XYZC2 (2, IB)                                      00002470
ISN 0279          YFUS (2, 3) = YAPEX (IB)                                         00002480
ISN 0280          ZFUS (2, 1) = ZAPEX (IB)                                         00002490
ISN 0281          ZFUS (2, 2) = XYZC2 (3, IB)                                      00002500
ISN 0282          ZFUS (2, 3) = ZAPEX (IB)                                         00002510
ISN 0283        300  IF (ITAFT .EQ. 0) GO TO 310
ISN 0285             YFUS (3, 1) = YAPEX (IB)
ISN 0286             YFUS (3, 2) = XYZC2 (2, IB)
ISN 0287             YFUS (3, 3) = YAPEX (IB)
ISN 0288             ZFUS (3, 1) = ZAPEX (IB)
ISN 0289             ZFUS (3, 2) = XYZC2 (3, IB)
ISN 0290             ZFUS (3, 3) = ZAPEX (IB)
ISN 0291        310  CONTINUE
ISN 0292             YFUS (NFORX, 1) = YAPEX (IB)
ISN 0293             YFUS (NFORX, 2) = XYZC2 (2, IB)
ISN 0294             IF (ITAFT .GT. 0) YFUS (NFORX, 2) = YAPEX (IB)
ISN 0296             YFUS (NFORX, 3) = YAPEX (IB)
ISN 0297             ZFUS (NFORX, 1) = ZAPEX (IB)
ISN 0298             ZFUS (NFORX, 2) = XYZC2 (3, IB)
ISN 0299             IF (ITAFT .GT. 0) ZFUS (NFORX, 2) = ZAPEX (IB)
ISN 0301             ZFUS (NFORX, 3) = ZAPEX (IB)
ISN 0302             DO 320 I = 1, NFORX
ISN 0303             NRADX = II (11)
ISN 0304             NWDS = NRADX
ISN 0305             IF (NRADX  .LT. 10) NWDS = 10
ISN 0307             WRITE (L3, 560) (YFUS (I, JJ), JJ = 1, NWDS)
ISN 0308             WRITE (6, 690) (YFUS (I, JJ), JJ = 1, NWDS)
ISN 0309             WRITE (L3, 570) (ZFUS (I, JJ), JJ = 1, NWDS)
ISN 0310             WRITE (6, 700) (ZFUS (I, JJ), JJ = 1, NWDS)
ISN 0311        320  CONTINUE
ISN 0312             GO TO 370
               C
               C    TREATMENT OF CURVED PANEL FUSELAGE
               C    GETTING X VALUES OF FUSELAGE
               C
ISN 0313        330  NXFUS = II (12)
ISN 0314             DO 340 JJ = 1, NXFUS
ISN 0315             XFUS (JJ) =XAPEX(NFUSE(1))+ XAFX (JJ, IB) *CSTART (IB) /100.
ISN 0316        340  CONTINUE
ISN 0317             WRITE (L3, 550) (XFUS (JJ), JJ = 1, NXFUS)
ISN 0318             WRITE (6, 680) (XFUS (JJ), JJ = 1, NXFUS)
               C
               C    GETTING THE FUSELAGE CAMBER LINE
               C
ISN 0319             ZRATIO = 0.
ISN 0320             IF (NPP (IB) .GT. 0) ZRATIO = 1.0
ISN 0322             DO 350 JJ = 1, NXFUS
ISN 0323             ZFUSS (JJ) = ZC12 (1, JJ, IB) *ZRATIO *CSTART (IB) /100.
ISN 0324        350  CONTINUE
ISN 0325             WRITE (L3, 900) (ZFUSS (JJ), JJ = 1, NXFUS)
ISN 0326             WRITE (6, 910) (ZFUSS (JJ), JJ = 1, NXFUS)
               C
               C    GETTING THE FUSELAGE CROSS-SECTIONAL AREAS, AFUS
               C    EACH VORLAX CROSS SECTION IS ASSUMED HAVE A CONSTANT RADIUS
               C
ISN 0327             DO 360  JJ = 1, NXFUS
ISN 0328             IF (NPP (IB) .GT. 0) ARATIO = ZC12 (2, JJ, IB) /100.
ISN 0330             IF (NPP (IB) .EQ. 0) ARATIO = 1.
ISN 0332              AFUS (JJ) = ARATIO *PI *RHO (IB) **2                              00003050
ISN 0333         360  CONTINUE                                                          00003060
ISN 0334              WRITE (L3, 920) (AFUS (JJ), JJ = 1, NXFUS)                        00003070
ISN 0335              WRITE (6, 930) (AFUS (JJ), JJ = 1, NXFUS)                         00003080
                C                                                                       00003090
                C   SETTING UP FOR NACELLES                                             00003100
                C                                                                       00003110
ISN 0336         370  IF (II (19) .EQ. 0) GO TO 410                                     00003120
ISN 0338              DO 400 JK = 1, NP                                                 00003130
ISN 0339              NW = NPPAN (JK)                                                   00003140
ISN 0340              PODORG (1) = XAPEX (NW)                                           00003150
ISN 0341              PODORG (2) = YAPEX (NW)                                           00003160
ISN 0342              PODORG (3) = ZAPEX (NW) - RHO (NW) *COS (DTR*PHEE (NW))           00003170
ISN 0343              WRITE (L3, 840) ((PODORG (KL), KL = 1, 3) , JK)                   00003180
ISN 0344              WRITE (6, 850) ((PODORG (KL), KL = 1, 3), JK)                     00003190
ISN 0345              DO 380 KK = 1, 10                                                 00003200
ISN 0346              XPOD (JK, KK) = 0.                                                00003210
ISN 0347              IF (KK .GT. NPODOR) GO TO 380                                     00003220
ISN 0349              XPOD (JK, KK) = XAFX (KK, NW) *CSTART (NW) /100.                  00003230
ISN 0350         380  CONTINUE                                                          00003240
ISN 0351              WRITE (L3, 860) (XPOD (JK, KK), KK = 1, 10) , JK                  00003250
ISN 0352              WRITE (6, 870) (XPOD (JK, KK) , KK = 1, 10) , JK                  00003260
ISN 0353              DO 390 KK = 1, 10                                                 00003270
ISN 0354              PODORD (JK, KK)  = 0.                                             00003280
ISN 0355              IF (KK  .GT. NPODOR) GO TO 390                                    00003290
ISN 0357              PODORD (JK, KK) = ZC12 (2, KK, NW)                                00003300
ISN 0358              IF (NPP(NW).NE.0) PODORD(JK, KK)=SQRT(ZC12(2,KK,NW)/100.)*RHO(NW) 00003310
ISN 0360         390  CONTINUE                                                          00003320
ISN 0361              WRITE (L3, 880) (PODORD (JK, KK), KK = 1, 10), JK                 00003330
ISN 0362              WRITE (6, 890) (PODORD (JK, KK), KK = 1, 10), JK                  00003340
ISN 0363         400  CONTINUE                                                          00003350
                C                                                                       00003360
                C SETTING UP FOR FINS                                                   00003370
                C                                                                       00003380
ISN 0364         410  IF (NF .EQ. 0) GO TO 440                                          00003390
ISN 0366              DO 420 NN = 1, NF                                                 00003400
ISN 0367              IB = NFPAN (NN)                                                   00003410
ISN 0368              ABCD (NN, 1, 1) = XAPEX (IB)                                      00003420
ISN 0369              ABCD (NN, 1, 2) = YAPEX (IB)                                      00003430
ISN 0370              ABCD (NN, 1, 3) = ZAPEX (IB)                                      00003440
ISN 0371              ABCD (NN, 1, 4) = CSTART (IB)                                     00003450
ISN 0372              ABCD (NN, 2, 1) = XYZC2 (1, IB)                                   00003460
ISN 0373              ABCD (NN, 2, 2) = XYZC2 (2, IB)                                   00003470
ISN 0374              ABCD (NN, 2, 3) = XYZC2 (3, IB)                                   00003480
ISN 0375              ABCD (NN, 2, 4) = XYZC2 (4, IB)                                   00003490
ISN 0376         420  CONTINUE                                                          00003500
ISN 0377              XFIN (1) = 0.                                                     00003510
ISN 0378              XFIN (2) = 100.                                                   00003520
ISN 0379              FINORD (1) = 0.                                                   00003530
ISN 0380              FINORD (2) = 0.                                                   00003540
ISN 0381              DO 430 NN = 1, NF                                                 00003550
ISN 0382              WRITE (6, 710) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)            00003560
ISN 0383              WRITE (L3, 580) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)           00003570
ISN 0384          WRITE (L3, 590) (XFIN (I), I = 1, 2)                         00003580
ISN 0385          WRITE (6, 720) (XFIN (I), I = 1, 2)                          00003590
ISN 0386          WRITE (L3, 600) (FINORD (I), I = 1, 2)                       00003600
ISN 0387          WRITE (6, 730) (FINORD (I), I = 1, 2)                        00003610
ISN 0388     430  CONTINUE                                                     00003620
             C                                                                 00003630
             C SETTING UP FOR CANARDS                                          00003640
             C                                                                 00003650
ISN 0389     440  IF (NCAN .EQ. 0) GO TO 470                                   00003660
ISN [illegible]   DO 450 IN = 1, [illegible]                                   00003670
[illegible]
ISN [illegible]   [illegible]
ISN [illegible]   [illegible]
[illegible]
ISN [illegible]   450 CONTINUE
ISN [illegible]   XCAN (1) = [illegible]
ISN [illegible]   XCAN (2) = [illegible]
ISN [illegible]   CANORD (1) = [illegible]
ISN [illegible]   CANORD (2) = [illegible]
ISN [illegible]   DO 460 NN = 1, NCAN
ISN 0407          WRITE (6, 750) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)       00003830
ISN 0408          WRITE (L3, 740) ((ABCD (NN, I, J), J = 1, 4), I = 1, 2)      00003840
ISN 0409          WRITE (L3, 760) (XCAN (I), I = 1, 2)                         00003850
ISN 0410          WRITE (6, 770) (XCAN (I), I = 1, 2)                          00003860
ISN 0411          WRITE (L3, 780) (CANORD (I), I = 1, 2)                       00003870
ISN 0412          WRITE (6, 790) (CANORD (I), I = 1, 2)                        00003880
ISN 0413     460  CONTINUE                                                     00003890
ISN 0414     470  WRITE (L3, 800) (PLOTSZ)                                     00003900
ISN 0415          WRITE (6, 810) (PLOTSZ)                                      00003910
ISN 0416          PISOSZ = PLOTSZ *1.2247                                      00003920
ISN 0417          WRITE (L3, 820) (PISOSZ)                                     00003930
ISN 0418          WRITE (6, 830) (PISOSZ)                                      00003940
ISN 0419     480  FORMAT (24I3)                                                00003950
ISN 0420     490  FORMAT (I7, 65X, 4HREFA)                                     00003960
ISN 0421     500  FORMAT (10F7.2,5H  XAF)                                      00003970
ISN 0422     510  FORMAT (4F7.2, 42X, 6H  WORG)                                00003980
ISN 0423     520  FORMAT (10F7.2, 7H  TZORD)                                   00003990
ISN 0424     530  FORMAT (10F7.3, 6H  WORD)                                    00004000
ISN 0425     540  FORMAT (6F7.2, 28X, 6H  XFUS)                                00004010
ISN 0426     550  FORMAT(10F7.2, 6H  XFUS)                                     00004020
ISN 0427     560  FORMAT (10F7.2, 6H  YFUS)                                    00004030
ISN 0428     570  FORMAT (10F7.2, 6H  ZFUS)                                    00004040
ISN 0429     580  FORMAT (8F7.1, 14X, 8H  FINORG)                              00004050
ISN 0430     590  FORMAT (2F7.1, 56X, 6H  XFIN)                                00004060
ISN 0431     600  FORMAT (2F7.1, 56X, 8H  FINORD)                              00004070
ISN 0432     610  FORMAT (1H , 24I3)                                           00004080
ISN 0433     620  FORMAT (1H , I7, 65X, 4HREFA)                                00004090
ISN 0434     630  FORMAT (1H , 10F7.2, 5H  XAF)                                00004100
ISN 0435       640  FORMAT (1H , 4F7.2, 42X, 6H  WORG)                                      00004110
ISN 0436       650  FORMAT (1H , 10F7.2, 7H  TZORD)                                         00004120
ISN 0437       660  FORMAT (1H , 10F7.3, 6H  WORD)                                          00004130
ISN 0438       670  FORMAT (1H , 6F7.2, 28X, 6H  XFUS)                                      00004140
ISN 0439       680  FORMAT (1H , 10F7.2, 6H  XFUS)                                          00004150
ISN 0440       690  FORMAT (1H , 10F7.2, 6H  YFUS)                                          00004160
ISN 0441       700  FORMAT (1H , 10F7.2, 6H  ZFUS)                                          00004170
ISN 0442       710  FORMAT (1H , 8F7.1, 14X, 8H  FINORG)                                    00004180
ISN 0443       720  FORMAT (1H , 2F7.1, 56X, 6H  XFIN)                                      00004190
ISN 0444       730  FORMAT (1H , 2F7.1, 56X, 8H  FINORD)                                    00004200
ISN 0445       740  FORMAT (8F7.1, 14X, 8H  CANORG)                                         00004210
ISN 0446       750  FORMAT (1H , 8F7.1, 14X, 8H  CANORG)                                    00004220
ISN 0447       760  FORMAT (2F7.1, 56X, 6H  XCAN)                                           00004230
ISN 0448       770  FORMAT (1H , 2F7.1, 56X, 6H  XCAN)                                      00004240
ISN 0449       780  FORMAT (2F7.1, 56X, 8H  CANORD)                                         00004250
ISN 0450       790  FORMAT (1H , 2F7.1, 56X, 8H  CANORD)                                    00004260
ISN 0451       800  FORMAT (3HX Y, 44X, F5.2, 3HORT)                                        00004270
ISN 0452       810  FORMAT (1H , 3HX Y, 44X, F5.2, 3HORT)                                   00004280
ISN 0453       820  FORMAT (3HX Z, 44X, F5.2, 7HORTISO1, 12X,1H1)                           00004290
ISN 0454       830  FORMAT (1H ,3HX Z,4X,'26.62-24.139.23',25X, F5.2, 3HORT, 16X,1H1 )00004300
ISN 0455       840  FORMAT (3F7.2, 51X, 6HPODORG, I2)                                       00004310
ISN 0456       850  FORMAT (1H , 3F7.2, 51X, 6HPODORG, I2)                                  00004320
ISN 0457       860  FORMAT (10F7.2, 2X, 6HXPOD  , I2)                                       00004330
ISN 0458       870  FORMAT (1H , 10F7.2, 2X, 6HXPOD  , I2)                                  00004340
ISN 0459       880  FORMAT (10F7.2, 2X, 6HPODORD, I2)                                       00004350
ISN 0460       890  FORMAT (1H , 10F7.2, 2X, 6HPODORD, I2)                                  00004360
ISN 0461       900  FORMAT (10F7.2, 6H  ZFUS)                                               00004370
ISN 0462       910  FORMAT (1H ,10F7.2, 6H  ZFUS)                                           00004380
ISN 0463       920  FORMAT (10F7.1, 6H  AFUS)                                               00004390
ISN 0464       930  FORMAT (1H ,10F7.1, 6H  AFUS)                                           00004400
ISN 0465            GO TO 30                                                                00004410
ISN 0466       940  STOP                                                                    00004420
ISN 0467            END                                                                     00004430
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                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****          PAGE 010

SYMBOL  INTERNAL STATEMENT NUMBERS
I       0018 0019 0020 0021 0022 0023 0023 0026 0028 0029 0030 0031 0033 0036 0038 0041 0056 0056 0056
        0059 0059 0059 0075 0078 0079 0080 0081 0082 0082 0082 0082 0083 0084 0084 0086 0086 0090 0092
        0093 0094 0095 0098 0102 0104 0106 0112 0114 0115 0116 0116 0116 0116 0116 0117 0119 0120 0126
        0127 0131 0136 0144 0145 0149 0149 0149 0153 0154 0221 0222 0226 0226 0226 0227 0227 0227 0229
        0230 0241 0302 0307 0308 0309 0310 0382 0382 0382 0383 0383 0383 0384 0384 0384 0385 0385 0385
        0386 0386 0386 0387 0387 0387 0407 0407 0407 0408 0408 0408 0409 0409 0409 0410 0410 0410 0411
        0411 0411 0412 0412 0412
J       0027 0030 0031 0034 0036 0039 0041 0107 0108 0382 0382 0382 0383 0383 0383 0407 0407 0407 0408
        0408 0408
K       0035 0036 0040 0041 0123 0123 0123 0124 0124 0124
C1      0007 0123
C2      0007 0124
IB      0170 0171 0173 0173 0177 0177 0179 0179 0179 0179 0187 0189 0189 0248 0249 0251 0252 0254 0254
        0259 0259 0265 0266 0267 0269 0270 0271 0272 0274 0277 0278 0279 0280 0281 0282 0285 0286 0287
        0288 0289 0290 0292 0293 0294 0296 0297 0298 0299 0301 0315 0315 0320 0323 0323 0328 0328 0330
        0332 0367 0368 0369 0370 0371 0372 0373 0374 0375 0392 0393 0394 0395 0396 0397 0398 0399 0400
II      0002 0154 0156 0157 0161 0163 0165 0167 0171 0173 0181 0183 0185 0187 0189 0191 0193 0194 0196
        0198 0199 0201 0203 0206 0208 0209 0215 0245 0303 0313 0336
IW      0222 0223 0223 0223 0223 0224 0224 0224 0224 0230 0232 0232 0232 0233 0233 0233 0235 0236 0238
        0239
JJ      0113 0113 0113 0113 0134 0134 0134 0135 0136 0136 0139 0139 0139 0142 0142 0142 0143 0144 0144
        0145 0145 0219 0219 0219 0220 0220 0220 0231 0232 0232 0233 0233 0235 0235 0235 0236 0236 0236
        0238 0238 0238 0239 0239 0239 0242 0242 0243 0243 0263 0263 0263 0264 0264 0264 0307 0307 0307
        0308 0308 0308 0309 0309 0309 0310 0310 0310 0314 0315 0315 0317 0317 0317 0318 0318 0318 0322
        0323 0323 0325 0325 0325 0326 0326 0326 0327 0328 0332 0334 0334 0334 0335 0335 0335
JK      0338 0339 0343 0344 0346 0349 0351 0351 0352 0352 0354 0357 0358 0361 0361 0362 0362
KK      0345 0346 0347 0349 0349 0351 0351 0351 0352 0352 0352 0353 0354 0355 0357 0357 0358 0358 0361
        0361 0361 0362 0362 0362
KL      0343 0343 0343 0344 0344 0344
L3      0017 0053 0208 0211 0219 0224 0226 0235 0238 0243 0263 0307 0309 0317 0325 0334 0343 0351 0361
        0383 0384 0386 0408 0409 0411 0414 0417
NF      0003 0044 0191 0193 0194 0364 0366 0381
NN      0366 0367 0368 0369 0370 0371 0372 0373 0374 0375 0381 0382 0383 0391 0392 0393 0394 0395 0396
        0397 0398 0399 0400 0406 0407 0408
NP      0003 0047 0201 0203 0204 0206 0338
NV      0102 0111
NW      0339 0340 0341 0342 0342 0342 0349 0349 0357 0358 0358 0358
PI      0016 0332
PO      0007 0113 0115
XS      0007 0149
X1      0076 0092
X2      0077 0078
Y1      0076 0093 0096
Y2      0077 0079 0096
Z1      0076 0094 0097
Z2      0077 0080 0097
ABS     0177 0179
COS     0342
CTR     0049 0098 0342
MAG     0054
ILE     0131 0137 0140
INV     0108 0109
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                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
ITS     0011 0116 0131
IWT     0225 0226 0227
LAX     0054
LAY     0054
MAX     0120 0123 0124
NAP     0116 0117 0129 0134 0135 0139 0142 0143 0159 0181 0185 0219 0220 0231 0235 0236 0238 0239 0242
        0243
NPP     0002 0116 0320 0328 0330 0358
NXS     0147 0149 0149 0151
NYS     0147
NZS     0147
PDL     0010 0083 0084 0090 0098 0163 0171 0173 0187 0189 0249
PHI     0007 0113 0114
PSI     0060 0061
RHO     0002 0115 0332 0342 0358
SPC     0014 0082
XAF     0006 0134 0136
ZC1     0006 0139 0144
ZC2     0006 0142 0145
ABCD    0002 0036 0368 0369 0370 0371 0372 0373 0374 0375 0382 0383 0393 0394 0395 0396 0397 0398 0399
        0400 0407 0408
AFUS    0006 0029 0332 0334 0335
CBAR    0069
CURV    0007 0082 0084 0086 0086
IBOT    0103 0109 0109 0111
ITOP    0106 0107 0111
MACH    0008 0013 0056
NAPX    0002 0117 0159 0183 0189 0204
NCAN    0003 0045 0196 0198 0199 0389 0391 0406
NPAN    0069 0075
NVOR    0008 0012 0082 0102 0108 0112 0173
NWDS    0260 0261 0263 0264 0304 0305 0307 0308 0309 0310
PHEE    0002 0114 0342
RLE1    0132 0137
RLE2    0133 0140
RNCV    0011 0082 0120
SLE1    0014 0126
SLE2    0014 0127
SQRT    0358
SREF    0069 0210
VINF    0060 0067 0067
XAFX    0002 0136 0217 0218 0219 0220 0315 0349
XBAR    0069
XCAN    0002 0021 0402 0403 0409 0410
XFIN    0002 0019 0377 0378 0384 0385
XFUS    0002 0023 0028 0251 0252 0255 0257 0259 0263 0264 0315 0317 0318
XPOD    0002 0346 0349 0351 0352
YAWQ    0060 0065
YFUS    0002 0030 0265 0266 0267 0269 0277 0278 0279 0285 0286 0287 0292 0293 0294 0296 0307 0308
YNOT    0151
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*****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
ZBAR    0069
ZC12    0002  0041  0144  0145  0232  0232  0233  0233  0235  0236  0238  0239  0323  0328  0357  0358
ZERO    0228  0242  0243
ZFUS    0002  0031  0270  0271  0272  0274  0280  0281  0282  0288  0289  0290  0297  0298  0299  0301  0309  0310
ZNOT    0151
AINC1   0009  0116
AINC2   0009  0116
ALPHA   0007  0059
ATAN2   0098
CORD1   0076  0095
CORD2   0077  0081
INPUT   0003  0051
ISOLV   0054
ISREF   0210  0211  0212
ISYNT   0116  0119  0121
ITAFT   0176  0179  0187  0255  0257  0283  0294  0299
JJTOP   0112  0113
LESWP   0008  0010
NCANP   0002  0003  0392
NFORX   0245  0259  0260  0261  0292  0293  0294  0296  0297  0298  0299  0301  0302
NFPAN   0002  0003  0367
NFUSE   0002  0003  0163  0170  0248  0315
NFUSP   0003  0046  0161  0168  0187  0246
NMACH   0056  0056
NPPAN   0002  0003  0048  0204  0339
NRADX   0303  0304  0305
NWING   0002  0003  0159  0183  0217  0218  0219  0220  0222  0225  0230
NWNGP   0003  0043  0157  0159  0165  0165  0181  0213  0221  0225  0229  0240
NXFUS   0313  0314  0317  0318  0322  0325  0326  0327  0334  0335
PSPAN   0012
ROLLQ   0060  0063
SYNTH   0010  0119
TAPER   0012
TITLE   0007  0052  0053  0058
WSPAN   0069  0071  0071
XAPEX   0010  0092  0177  0179  0223  0224  0251  0259  0315  0340  0368  0393
XFEND   0254  0255  0257
XYZC2   0002  0078  0079  0080  0081  0177  0179  0179  0226  0227  0233  0252  0254  0254  0266  0271  0278  0281  0286
        0289  0293  0298  0372  0373  0374  0375  0397  0398  0399  0400
YAPEX   0010  0093  0223  0224  0265  0267  0269  0277  0279  0285  0287  0292  0294  0296  0341  0369  0394
ZAPEX   0010  0094  0223  0224  0270  0272  0274  0280  0282  0288  0290  0297  0299  0301  0342  0370  0395
ZFUSS   0006  0323  0325  0326
ARATIO  0328  0330  0332
CANORD  0002  0022  0404  0405  0411  0412
CSTART  0012  0095  0179  0223  0224  0232  0259  0315  0323  0349  0371  0396
DELTAY  0096  0098  0151
DELTAZ  0097  0098  0151
DESCRP  0007  0076  0077  0082
FINORD  0002  0020  0379  0380  0386  0387
FLOATX  0054
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

SYMBOL  INTERNAL STATEMENT NUMBERS
FLOATY  0054
INTRAC  0089  0090  0098  0100  0131
INVERS  0074  0125
IQUANT  0010  0116
ITNOSE  0175  0177  0187  0252  0255  0257  0267  0272  0275
ITRMAX  0054
LATRAL  0060  0061  0063  0065
LSTDTB  0015
NALPHA  0059  0059
NPCOOR  0204  0206  0347  0355
NWNGP1  0240  0241
PISOSZ  0416  0417  0418
PITCHQ  0060
PLOTSZ  0003  0050  0414  0415  0416
PCOORD  0002  0354  0357  0358  0361  0362
PCOORG  0002  0340  0341  0342  0343  0344
REXPAR  0054
ZRATIO  0319  0320  0323
```

```
                  *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****

LABEL   DEFINED   REFERENCES
   10   0004      0052  0053
   20   0005      0058
   30   0017      0465
   40   0025      0018
   50   0032      0026  0027
   60   0037      0033  0034  0035
   70   0042      0038  0039  0040
   80   0055      0054
   90   0057      0056  0059  0060
  100   0070      0069
  110   0073      0113  0123  0124  0134  0137  0139  0140  0142  0149  0151
  120   0088      0076  0077  0082
  130   0110      0107
  140   0111      0104
  150   0116      0100
  160   0118      0116
  170   0129      0121
  180   0136      0135
  190   0145      0143
  200   0146      0075  0128  0129
  210   0148      0147
  220   0155      0153
  230   0181      0168
  240   0219      0215
  250   0224      0221
  260   0234      0231
  270   0237      0229
  280   0244      0241
  290   0245      0213
  300   0283      0275
  310   0291      0283
  320   0311      0302
  330   0313      0249
  340   0316      0314
  350   0324      0322
  360   0333      0327
  370   0336      0246  0312
  380   0350      0345  0347
  390   0360      0353  0355
  400   0363      0338
  410   0364      0336
  420   0376      0366
  430   0388      0381
  440   0389      0364
  450   0401      0391
  460   0413      0406
  470   0414      0389
  480   0419      0208
  490   0420      0211
  500   0421      0219
  510   0422      0224  0226
  520   0423      0235  0238
```

```
                    ******FORTRAN CROSS REFERENCE LISTING******

LABEL   DEFINED   REFERENCES
 530    0424      0243
 540    0425      0263
 550    0426      0317
 560    0427      0307
 570    0428      0309
 580    0429      0383
 590    0430      0384
 600    0431      0386
 610    0432      0209
 620    0433      0212
 630    0434      0220
 640    0435      0223  0227
 650    0436      0236  0239
 660    0437      0242
 670    0438      0264
 680    0439      0318
 690    0440      0308
 700    0441      0310
 710    0442      0382
 720    0443      0385
 730    0444      0387
 740    0445      0408
 750    0446      0407
 760    0447      0409
 770    0448      0410
 780    0449      0411
 790    0450      0412
 800    0451      0414
 810    0452      0415
 820    0453      0417
 830    0454      0418
 840    0455      0343
 850    0456      0344
 860    0457      0351
 870    0458      0352
 880    0459      0361
 890    0460      0362
 900    0461      0325
 910    0462      0326
 920    0463      0334
 930    0464      0335
 940    0466      0051
```

```
                                       /     MAIN /     SIZE OF PROGRAM 007FA8 HEXADECIMAL BYTES PAGE 016

NAME     TAG   TYPE  ADD.     NAME     TAG   TYPE  ADD.     NAME     TAG   TYPE  ADD.     NAME     TAG   TYPE  ADD.
     I SF      I*4  0004E0         J SF      I*4  0004E4         K SF      I*4  0004E8        C1 S       R*4  000634
    C2 S       R*4  000694        IB SFA     I*4  0004EC        II SF      I*4  0006D4        IW SF      I*4  0004F0
    JJ SF      I*4  0004F4        JK SF      I*4  0004F8        KK SFA     I*4  0004FC        KL  F      I*4  000500
    L3 SF      I*4  000504        NF SF      I*4  000508        NN SF      I*4  00050C        NP SF      I*4  000510
    NV SF      I*4  000514        NW SFA     I*4  000518        PI SF      R*4  00051C        RO SF      R*4  000734
    XS S       R*4  000800        X1 SF      R*4  000520        X2 SF      R*4  000524        Y1 SF      R*4  000528
    Y2 SF      R*4  00052C        Z1 SF      R*4  000530        Z2 SF      R*4  000534       DTR SFA     R*4  000538
   MAG S       R*4  00053C       ILE S       I*4  000540       INV SF      I*4  000544       ITS SF   C  I*4  000050
   IWT SF      I*4  000548       LAX S       I*4  00054C       LAY S       I*4  000550       MAX SF      I*4  000554
   NAP SF      I*4  000558       NPP S       I*4  000850       NXS SF      I*4  00055C       NYS S       I*4  000560
   NZS S       I*4  000564       PDL S    C  R*4  0001E0       PHI SF      R*4  0008A0       PSI S       R*4  000568
   RHO SF      R*4  00094C       SPC S    C  R*4  0000A0       XAF SF      R*4  0009BC       ZC1 SF      R*4  000A84
   ZC2 SF      R*4  000B4C      ABCD SF      R*4  000C14      AFUS SF      R*4  000CD4      CBAR S       R*4  00056C
  CURV S       R*4  000D4C      IBOT SF      I*4  000570      ITOP SF      I*4  000574      MACH S    C  R*4  000000
  NAPX SF      I*4  000DEC      NCAN SF      I*4  000578      NPAN SF      I*4  00057C      NVOR SF   C  R*4  0001E0
  NWDS SF      I*4  000580      PHEE SFA     R*4  000E8C      RLE1 S       R*4  000584      RLE2 S       R*4  000588
  RNCV SF   C  R*4  000000      SLE1 S    C  R*4  000000      SLE2 S    C  R*4  000050      SREF SF      R*4  00058C
  VINF S       R*4  000590      XAFX SF      R*4  000EDC      XBAR S       R*4  000594      XCAN SF      R*4  00219C
  XFIN SF      R*4  0021C4      XFUS SF      R*4  0021EC      XPOD SF      R*4  002264      YAWQ S       R*4  000598
  YFUS SF      R*4  0023CC      YNOT S       R*4  00059C      ZBAR S       R*4  0005A0      ZC12 SFA     R*4  00219C
  ZERO SF      R*4  0005A4      ZFUS SF      R*4  004C1C      ZNOT S       R*4  0005A8     AINC1 S    C  R*4  000000
 AINC2 S    C  R*4  000050     ALPHA S       R*4  004EEC     CORD1 SF      R*4  0005AC     CORD2 SF      R*4  0005B0
 INPUT  F            000001     ISOLV S       I*4  0005B4     ISREF SF      I*4  0005B8     ISYNT SF      I*4  0005BC
 ITAFT SF      I*4  0005C0     JJTOP SF      I*4  0005C4     LESWP       C  R*4    N.R.     NCAMP  F      I*4  004F0C
 NFORX SF      I*4  0005C8     NFPAN  F      I*4  004F14     NFUSE  F      I*4  004F2C     NFUSP S       I*4  0005CC
 NMACH SF      I*4  0005D0     NPPAN SF      I*4  004F44     NRADX SF      I*4  0005D4     NWING  F      I*4  004F68
 NWNGP SF      I*4  0005D8     NXFUS SF      I*4  0005DC     PSPAN       C  R*4    N.R.     ROLLQ S       R*4  0005E0
 SYNTH S    C  R*4  000320     TAPER       C  R*4    N.R.     TITLE SF      R*4  004FB8     WSPAN S       R*4  0005E4
 XAPEX SFA  C  R*4  000000     XFEND SF      R*4  0005E8     XYZC2 SFA     R*4  005008     YAPEX SF   C  R*4  0000A0
 ZAPEX SF   C  R*4  000140     ZFUSS SF      R*4  0052B8      SQRT      XF  R*4  000000       COS      XF  R*4  000000
 ATAN2      XF  R*4  000000    ARATIO SF      R*4  0005EC    CANORD SF      R*4  005300    CSTART SFA  C  R*4  000000
DELTAY SFA     R*4  0005F0    DELTAZ SFA     R*4  0005F4    DESCRP S       R*4  005328    FINORD SF      R*4  005350
FLOATX S       R*4  0005F8    FLOATY S       R*4  0005FC    FRONL*  F  XF  I*4  000000    IBCOM*  F  XF  R*4  000000
INTRAC SF      I*4  000600    INVERS S       I*4  000604    IQUANT S    C  I*4  0003C0    ITNOSE SF      I*4  000608
ITRMAX S       I*4  00060C    LATRAL S       I*4  000610    LSTOTR SF  XF  I*4  000000    NALPHA SF      I*4  000614
NPODOR SF      I*4  000618    NWNGP1 SF      I*4  00061C    PISOSZ SF      R*4  000620    PITCHQ S       R*4  000624
PLOTSZ SF      R*4  000628    PODORD SF      R*4  005378    PODORG SF      R*4  0054E0    REXPAR S       R*4  00062C
ZRATIO SF      R*4  000630

                                   *****   COMMON INFORMATION   *****

   NAME OF COMMON BLOCK  *  SET4*   SIZE OF BLOCK    0000A0 HEXADECIMAL BYTES

 VAR. NAME   TYPE  REL. ADDR.   VAR. NAME   TYPE  REL. ADDR.   VAR. NAME   TYPE  REL. ADDR.   VAR. NAME   TYPE  REL. ADDR.
    AINC1     R*4    000000        AINC2     R*4    000050

   NAME OF COMMON BLOCK  *  SET5*   SIZE OF BLOCK    000460 HEXADECIMAL BYTES

 VAR. NAME   TYPE  REL. ADDR.   VAR. NAME   TYPE  REL. ADDR.   VAR. NAME   TYPE  REL. ADDR.   VAR. NAME   TYPE  REL. ADDR.
```

```
  XAPEX     R*4   000000        YAPEX    R*4   0000A0        ZAPEX    R*4   000140           PDL    R*4   0001E0
  LESWP     R*4     N.R.        SYNTH    R*4   000320       IQUANT    I*4   0003C0

 NAME OF COMMON BLOCK  *SET7*   SIZE OF BLOCK    0000A0 HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.
   RNCV     R*4   000000          ITS    I*4   000050

 NAME OF COMMON BLOCK  *SET12*  SIZE OF BLOCK    000280 HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.
  CSTAXY    R*4   000000        TAPER    R*4     N.R.        PSPAN    R*4     N.R.          NVOR    R*4   0001E0

 NAME OF COMMON BLOCK  *SET13*  SIZE OF BLOCK    000020 HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.
   MACH     R*4   000000

 NAME OF COMMON BLOCK  *SET23*  SIZE OF BLOCK    000140 HEXADECIMAL BYTES

VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.  VAR. NAME  TYPE  REL. ADDR.
   SLE1     R*4   000000         SLE2    R*4   000050          SPC    R*4   0000A0
   LABEL    ADDR                 LABEL    ADDR                LABEL    ADDR                LABEL    ADDR                PAGE 018

      30   005618                   40   005698                  50   005718                  60   00577C
      70   0057F8                  130   005D9A                 140   005DAE                 150   005E5C
     170   006008                  180   006088                 190   0061BA                 200   0061F4
     220   0062D8                  230   00647E                 240   006A82                 250   006794
     260   006966                  270   006A1A                 280   006B54                 290   006B68
     300   006E5E                  310   006EF0                 320   00715E                 330   007176
     340   0071D4                  350   00720C                 360   0073F2                 370   007488
     380   007632                  390   0077CC                 400   00788E                 410   0078A2
     420   007982                  430   0078B4                 440   0078C8                 450   007CA8
     460   007ED8                  470   007EEC                 940   007F6C
```

LOCKHEED PROPRIETARY DATA

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LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*      NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,

*OPTIONS IN EFFECT*      SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF

*STATISTICS*     SOURCE STATEMENTS =      466 ,PROGRAM SIZE =    32680

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******
```

```
LEVEL 21.8 ( JUN 74 )                    OS/360  FORTRAN H                            DATE  77.061/21.16.12
```

LOCKHEED PROPRIETARY DATA

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LOCKHEED PROPRIETARY DATA

```
      COMPILER OPTIONS - NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,
                         SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF
ISN 0002            SUBROUTINE LSTDT8                                            00004440
          C                                                                      00004450
ISN 0003            DIMENSION A (20)                                             00004460
ISN 0004            WRITE (6, 40)                                                00004470
ISN 0005         10 I = 0                                                        00004480
ISN 0006         20 READ (5, 50,END=30) A                                        00004490
ISN 0007            WRITE (6, 80) A                                              00004510
ISN 0008            I = I + 1                                                    00004520
ISN 0009            IF (I .NE. 44) GO TO 20                                      00004530
ISN 0011            WRITE (6, 60)                                                00004540
ISN 0012            GO TO 10                                                     00004550
ISN 0013         30 REWIND 5                                                     00004560
ISN 0014            WRITE (6, 70)                                                00004570
ISN 0015            RETURN                                                       00004580
ISN 0016         40 FORMAT (1H1, 26HINPUT DATA LISTING FOLLOWS /1H )             00004590
ISN 0017         50 FORMAT (20A4)                                                00004600
ISN 0018         60 FORMAT (1H1)                                                 00004610
ISN 0019         70 FORMAT (1H0, 17HINPUT DATA LISTED)                           00004620
ISN 0020         80 FORMAT (1H , 20A4)                                           00004630
ISN 0021            END                                                          00004640
```

```
                    *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G-****

SYMBOL  INTERNAL STATEMENT NUMBERS
A       0003  0006  0007
I       0005  0008  0008  0009
LSTDT8  0002
```

```
                         *****F O R T R A N   C R O S S   R E F E R E N C E   L I S T I N G*****
LABEL   DEFINED   REFERENCES
  10     0005      0012
  20     0006      0009
  30     0013      0006
  40     0016      0004
  50     0017      0006
  60     0018      0011
  70     0019      0014
  80     0020      0007
```

```
                                          /   LSTDT8 /     SIZE OF PROGRAM 00021C HEXADECIMAL BYTES PAGE 004

NAME     TAG    TYPE  ADD.          NAME      TAG    TYPE  ADD.         NAME    TAG   TYPE  ADD.          NAME     TAG    TYPE  ADD.
   A SF         R*4  0000E4                I SF      I*4  0000DC      IBCOM#  F  XF  I*4  000000       LSTDT8           I*4  0000E0
```

```
    LABEL    ADDR                    LABEL    ADDR                    LABEL    ADDR                    LABEL    ADDR              PAGE 005

       10   000168                      20   00016C                      30   0001D8
```

LOCKHEED PROPRIETARY DATA

THIS DATA CONTAINS INFORMATION AND/OR DESIGNS WHICH ARE THE PROPEHTY OF LOCKHEED AIRCRAFT CORPORATION.
RECIPIENT, BY ACCEPTING THE SAME, AGREES THAT THE DATA WILL NOT BE REPRODUCED, TRANSFERRED TO OTHER DOCUMENTS, DISCLOSED OUTSIDE OF THE RECIPIENT ORGANIZATION, OR USED FOR MANUFACTURING OR PROCUREMENT WITHOUT THE EXPRESS WRITTEN PERMISSION OF LOCKHEED AIRCRAFT CORPORATION. THIS LIMITATION MAY BE REMOVED OCTOBER 1977.

LOCKHEED PROPRIETARY DATA

```
*OPTIONS IN EFFECT*      NAME=  MAIN,OPT=01,LINECNT=55,SIZE=0000K,

*OPTIONS IN EFFECT*      SOURCE,BCD,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,XREF

*STATISTICS*     SOURCE STATEMENTS =      20 ,PROGRAM SIZE =      540

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                           93K BYTES OF CORE NOT USED

*STATISTICS*  NO  DIAGNOSTICS THIS STEP
```

```
F128-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED LIST,MAP
         DEFAULT OPTION(S) USED -  SIZE=(131072,18432)
IEW0000     INCLUDE COMPILE
IEW0000     ENTRY MAIN


                                                       MODULE MAP

  CONTROL SECTION                         ENTRY

    NAME     ORIGIN   LENGTH                NAME    LOCATION      NAME   LOCATION      NAME   LOCATION       NAME   LOCATION

  MAIN           00     7FA8
  LSTDT8       7FA8      21C
  IHCSATN2*    81C8      1C8
                                          ATAN2        81C8      ATAN          81DC
  IHCSSCN *    8390      1D9
                                          COS          8398      SIN           83B0
  IHCNAMEL*    8578      AA7
                                          FRDNL#       8578      FWRNL#        8B60
  IHCECOMH*    9020      F31
                                          IBCOM#       9020      FDIOCS#       90DC      VFIOCS       9E40      INTSW         9F3E
                                          INTSWTCH     9F3E
  IHCCOMH2*    9F58      56D
                                          SEQDASD      A1E0
  IHCSSQRT*    A4C8      145
                                          SQRT         A4C8
  IHCFCVTH*    A610     1195
                                          ADCON#       A610      FCVAOUTP      A6BA      FCVLOUTP     A74A      FCVZOUTP      AE9A
                                          FCVIOUTP     AC40      FCVEOUTP      B142      FCVCOUTP     B35C      INT6SWCH      B643
  IHCEFNTH*    B7A8      512
                                          ARITH#       B7A8      ADJSWTCH      BB14
  IHCEFIOS*    BCC0     1390
                                          FIOCS#       BCC0      FIOCSBEP      BCC6      MULFLS       BE7C
  IHCERRM *    D050      5BC
                                          ERRMON       D050      IHCERRE       D068
  IHCUOPT *    D610      350
  IHCETRCH*    D960      28E
                                          IHCTRCH      D960      ERRTRA        D968
  IHCUATBL*    D8F0      648
  SET4         E238       A0
  SET5         E2D8      460
  SET7         E738       A0
  SET12        E7D8      280
  SET13        EA58       20
  SET23        EA78      140

 ENTRY ADDRESS        00
 TOTAL LENGTH       EBB8

****GOMODULE  DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET
```

INPUT DATA LISTING FOLLOWS

```
 &INPUT
 NWNGP=5,NWING=1,2,3,4,5, NFUSP=1, NFUSE=6,NF=2,NFPAN=9,10,
 NCAN=1,NCANP=11,NP=2,NPPAN=7,8, PLOTSZ=10.,
 &END
CL1607-32   (-24 PLANFORM)  VC121 ENGINE
0          0          1              -0.0200     0.0       0.0       0.0   0       0
1              2.550
3              0.0       5.000        10.000
0              0.0       0.0           0.0        0.0        0.0
11         967680.00     1.0000        0.0        0.0      1290.0996
   944.0999   65.7400   -54.9600  1448.9399               WING PANEL NO. 1
  1462.5000  223.9400   -54.4700   925.9700               WING PANEL NO. 1
     3.0000   10.0000     1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0       0.0     0     13          0          0          0
     0.0       1.0000     5.0000    10.0000    20.0000   30.0000   40.0000   50.0000
    60.0000   70.0000    80.0000    90.0000   100.0000
     0.0      -0.0129    -0.1367    -0.4893    -1.2589   -1.9373   -2.4770   -2.8862
    -3.1954   -3.4439    -3.6668    -3.9008    -4.1644
     0.0       0.0529     0.2700     0.3078     0.1145   -0.2430   -0.6825   -1.1609
    -1.6545   -2.1469    -2.6232    -3.0692    -3.4807
  1462.5000  223.9400   -54.4700   925.9700               WING PANEL NO. 2
  1768.7998  317.4099   -69.0000   650.0098               WING PANEL NO. 2
     3.0000   10.0000     1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0       0.0     0     13          0          0          0
     0.0       1.0000     5.0000    10.0000    20.0000   30.0000   40.0000   50.0000
    60.0000   70.0000    80.0000    90.0000   100.0000
     0.0       0.0529     0.2700     0.3078     0.1145   -0.2430   -0.6825   -1.1609
    -1.6545   -2.1469    -2.6232    -3.0692    -3.4807
     0.0       0.0138     0.1708     0.3492     0.4138    0.3277    0.1538   -0.0785
    -0.3554   -0.6585    -0.9846    -1.3231    -1.6677
  1768.7998  317.4099   -69.0000   650.0098               WING PANEL NO. 3
  1905.3999  368.0398   -77.1600   529.8699               WING PANEL NO. 3
     3.0000   10.0000     1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0       0.0     0     13          0          0          0
     0.0       1.0000     5.0000    10.0000    20.0000   30.0000   40.0000   50.0000
    60.0000   70.0000    80.0000    90.0000   100.0000
     0.0       0.0138     0.1708     0.3492     0.4138    0.3277    0.1538   -0.0785
    -0.3554   -0.6585    -0.9846    -1.3231    -1.6677
     0.0       0.0151     0.0774     0.2623     0.3095    0.2567    0.1378   -0.0226
    -0.2227   -0.4511    -0.7002    -0.9606    -1.2362
  1905.3999  368.0398   -77.1600   529.8699               WING PANEL NO. 4
  2225.7998  486.8298   -89.7400   311.7200               WING PANEL NO. 4
     3.0000   10.0000     1.0000     0.0                  NVOR,RNCV,SPC,PDL
     0.0       0.0     0     13          0          0          0
```

```
      0.0      1.0000      5.0000     10.0000     20.0000     30.0000     40.0000     50.0000
  60.0000     70.0000     80.0000     90.0000    100.0000
      0.0      0.0151      0.0774      0.2625      0.3095      0.2567      0.1378     -0.0226
  -0.2227     -0.4511     -0.7002     -0.9606     -1.2362
      0.0     -0.0257     -0.1123     -0.1155      0.0513      0.1283      0.1925      0.2310
   0.2631      0.2919      0.3112      0.3272      0.3368
2223.7998    486.8799    -89.7400    311.7200               WING PANEL NO. 6
2479.2998    665.0498    -99.9600    194.4500               WING PANEL NO. 6
   3.0000     10.0000      1.0000         0.0               NVOR,RNCV,SPC,PDL
      0.0         0.0 0          13          0           0           0
      0.0      1.0000      5.0000     10.0000     20.0000     30.0000     40.0000     50.0000
  60.0000     70.0000     80.0000     90.0000    100.0000
      0.0     -0.0257     -0.11       -0.1155      0.0513      0.1283      0.1893      0.2310
   0.2631      0.2951                  0.3272      0.3368
      0.0     -0.0611       .1866     -0.3137     -0.4371     -0.4731     -0.4628     -0.3651
  -0.2057     -0.0051      0.2676      0.5811      0.9103
      0.0         0.0     45.7619   3524.0000               FUSELAGE PANEL
      0.0         0.0    -97.8677   3524.0000               FUSELAGE PANEL
   4.0000     28.0000      1.0000    999.0000               NVOR,RNCV,SPC,PDL
  90.0000     71.8148     52.0879     71.8148     14.1758     71.8148    -23.7363     71.8148
 -90.0000     71.8148
      0.0         0.0 1          29          0           0           1
      0.0      3.4052      6.8104     10.2157     13.6209     17.0261     20.4313     23.8365
  27.2418     30.6470     34.0522     37.4574     40.8627     44.2679     47.6731     54.4835
  60.1589     63.5641     66.9693     70.3746     75.6044     77.1850     80.5902     83.9955
  87.4007     90.8059     94.2111     97.6163    100.0000
  -1.0783     -0.8726     -0.6739     -0.5250     -0.4597     -0.4512     -0.4881     -0.5921
  -0.7616     -0.9293     -1.0423     -1.1501     -1.2789     -1.4015     -1.5232     -1.7477
  -1.9552     -2.0687     -2.1283     -2.1737     -2.1793     -2.1737     -2.1254     -2.0233
  -1.8927     -1.7281     -1.5125     -1.2571     -1.0499
      0.0      5.1227     17.7443     32.3533     50.2150     67.5458     84.8766    100.0000
 100.0000    100.0000    100.0000    100.0000    100.0000    100.0000    100.0000    100.0000
 100.0000    100.0000    100.0000    100.0000    100.4297     95.0974     81.7659     64.7005
  43.7282     27.5516     15.2879      5.4190         0.0
2094.0000    214.0000     -0.0800    393.0000               NACELLE PANEL NO 1
2094.0000    214.0000     -0.0800    393.0000               NACELLE PANEL NO 1
   8.0000      5.0000         0.0    999.0000               NVOR,RNCV,SPC,PDL
  90.0000     33.9200     45.0000     33.9200         0.0     33.9200    -45.0000     33.9200
 -90.0000     33.9200   -135.0000     33.9200   -180.0000     33.9200   -225.0000     33.9200
-270.0000     33.9200
      0.0         0.0 0           3          0           0           1
      0.0     12.1522    100.0000
      0.0
 100.0000    105.1001    105.1001
```

```
2091.0000  204.0000 -104.0000  394.0000            NACELLE PANEL NO 2
2091.0000  204.0000 -104.0000  394.0000            NACELLE PANEL NO 2
   8.0000    9.0000    0.0     999.0000            NVCR,RNCV,SPC,PDL
  90.0000   32.0000   45.0000   32.0000    0.0      32.0000  -45.0000   32.0000
 -90.0000   32.0000 -135.0000   32.0000 -180.0000   32.0000 -225.0000   32.0000
-270.0000   32.0000
   0.0       0.0    0          3          0          0          1
   0.0      11.9148   100.0000
   0.0
 100.0000  111.4062  111.4062
2497.0000  644.0000 -100.0000  194.5000            FIN PANEL NO. 1
2597.7999  644.0000  -28.0000  141.1000            FIN PANEL NO. 1
   2.0000   10.0000    1.0000    0.0               NVCR,RNCV,SPC,PDL
   0.0       0.0    0          0          0          0          0
3181.8999    0.0     -27.0000  294.0999            FIN PANEL NO. 2
3403.2000    0.0      64.2000   67.7000            FIN PANEL NO. 2
   2.0000   10.0000    1.0000    0.0               NVCR,RNCV,SPC,PDL
   0.0       0.0    0          0          0          0          0
3116.3999   33.0000  -40.0000  293.7998            CANARD PANEL NO. 1
3354.0000  174.4000   -7.0000   76.4000            CANARD PANEL NO. 1
   2.0000   10.0000    1.0000    0.0               NVCR,RNCV,SPC,PDL
   0.0       0.0    0          0          0          0          0
0          0        0                    NXS,NYS,NZS
INPUT DATA LISTED
```

```
CL1607-32   (-24 PLANFORM)   VC121 ENGINE
  1  1 -1  1  1  1  0  6 13  1  5 29  0  0  0  0  0  0  2  3  2  2  1  2
  96760                                                                 REFA
    0.0   1.00   5.00  10.00  20.00  30.00  40.00  50.00  60.00  70.00 XAF
  80.00  90.00 100.00
 944.10  65.76 -54.911448.94                                            WORG
1462.50 223.96 -56.47 925.97                                            WORG
1768.80 317.41 -69.00 650.01                                            WORG
1905.40 368.04 -77.16 529.87                                            WORG
2225.80 486.88 -89.74 311.72                                            WORG
2479.30 645.05 -99.96 194.45                                            WORG
    0.0  -0.19  -1.98  -7.09 -18.24 -28.07 -35.89 -41.82 -46.30 -49.90 TZORD
 -53.13 -56.52 -60.34
    0.0   0.49   2.50   2.83   1.06  -2.25  -6.32 -10.75 -15.32 -19.88 TZORD
 -24.29 -28.42 -32.23
    0.0   0.09   1.11   2.27   2.69   2.13   1.00  -0.51  -2.31  -4.28 TZORD
  -6.40  -8.60 -10.84
    0.0   0.08   0.41   1.39   1.64   1.36   0.73  -0.12  -1.18  -2.39 TZORD
  -3.71  -5.09  -6.55
    0.0  -0.08  -0.35  -0.36   0.16   0.40   0.59   0.72   0.82   0.92 TZORD
   0.97   1.02   1.05
    0.0  -0.08  -0.35  -0.61  -0.85  -0.92  -0.90  -0.71  -0.40  -0.01 TZORD
   0.52   1.13   1.77
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0 WORD
    0.0    0.0    0.0
    0.0 120.00 240.00 360.00 480.00 600.00 720.00 840.00 960.001080.00 XFUS
1200.001320.001440.001560.001680.001920.002120.002240.002360.002480.00 XFUS
2664.302720.002840.002960.003080.003200.003320.003440.003524.00
 -38.00 -30.75 -23.75 -18.50 -16.20 -15.90 -17.20 -20.90 -26.84 -32.75 ZFUS
 -36.73 -40.53 -45.07 -49.39 -53.68 -61.59 -68.90 -72.90 -75.00 -76.60 ZFUS
 -76.80 -76.60 -74.90 -71.30 -66.70 -60.90 -53.30 -44.30 -37.00
    0.0  830.0 2875.0 5242.0 8136.010944.013752.016202.316202.316202.3 AFUS
16202.316202.316202.316202.316202.316202.316202.316202.316202.316202.3 AFUS
16271.915408.013248.010483.0 7085.0 4464.0 2477.0  878.0    0.0
2094.00 214.00  -0.08                                                   PODORG 1
    0.0  47.76 393.00    0.0    0.0    0.0    0.0    0.0    0.0    0.0 XPOD
  33.92  34.77  34.77    0.0    0.0    0.0    0.0    0.0    0.0    0.0 PODORD
2091.00 204.00-104.00                                                   PODORG 2
    0.0  46.94 394.00    0.0    0.0    0.0    0.0    0.0    0.0    0.0 XPOD
  32.00  33.78  33.78    0.0    0.0    0.0    0.0    0.0    0.0    0.0 PODORD
 2480.0  645.0 -100.0  194.5 2595.4  645.0  -28.0  141.1               FINORG
    0.0  100.0                                                          XFIN
    0.0    0.0                                                          FINORD
 3183.9    0.0  -27.0  294.1 3403.2    0.0   66.5   67.7               FINORG
    0.0  100.0                                                          XFIN
    0.0    0.0                                                          FINORD
 3116.4   33.0  -40.0  283.8 3354.0  174.4  -40.0   76.4               CANORG
    0.0  100.0                                                          XCAN
    0.0    0.0                                                          CANORD
X Y                                          10.00ORT
X Z     26.62-24.139.23                      12.25ORT                  1
```

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16. ABSTRACT

A vortex lattice method applicable to both subsonic and supersonic flow is described. It is shown that if the discrete vortex lattice is considered as an approximation to the surface-distributed vorticity, then the concept of the generalized principal part of an integral yields a residual term to the vorticity-induced velocity field. The proper incorporation of this term to the velocity field generated by the discrete vortex lines renders the present vortex lattice method valid for supersonic flow. Special techniques for simulating nonzero thickness lifting surfaces and fusiform bodies with vortex lattice elements are included. Thickness effects of wing-like components are simulated by a double (biplanar) vortex lattice layer, and fusiform bodies are represented by a vortex grid arranged on a series of concentrical cylindrical surfaces. The analysis of sideslip effects by the subject method is described. Numerical considerations peculiar to the application of these techniques are also discussed. A summary comparison of the results obtained by the method of this report with other theoretical and experimental results is presented. The method has been implemented in a digital computer code identified as VORLAX. A users manual is included along with a complete Fortran compilation and executed case. Also included are conversion programs useful for transforming input between VORLAX and the NASA Wave Drag program.

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